

# ANNALS OF SURGERY

A MONTHLY REVIEW OF SURGICAL SCIENCE AND PRACTICE.

EDITED BY

LEWIS STEPHEN PILCHER, A.M., M.D.,

OF NEW YORK,

Surgeon to the Methodist Episcopal Hospital,

WITH THE COLLABORATION OF

J. WILLIAM WHITE, Ph.D., M.D.,

OF PHILADELPHIA,

Professor of Clinical Surgery, University of  
Pennsylvania; Surgeon to the University  
Hospital.

WILLIAM MACEWEN, M.D.,

OF GLASGOW,

Professor of Surgery in the University of  
Glasgow.

W. H. A. JACOBSON, M.Ch.,

OF LONDON,

Assistant Surgeon to Guy's Hospital.

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## CONTRIBUTORS TO VOL. XXVIII.

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JOHN F. BINNIE, M.D., of Kansas City, Mo.

GEORGE EMERSON BREWER, M.D., of New York, Attending Surgeon to the City Hospital; Assistant Demonstrator of Anatomy, College of Physicians and Surgeons.

A. T. BRISTOW, M.D., of New York, Surgeon to the Long Island College Hospital.

WILLIAM T. BULL, M.D., of New York, Attending Surgeon to the New York Hospital; Attending Surgeon to the Hospital for Ruptured and Crippled, and Consulting Surgeon to the New York Cancer Hospital.

NORMAN BRUCE CARSON, M.D., of St. Louis.

S. CATELLANI, M.D., of Padua, First Assistant in the Surgical Clinic of Professor E. Tricomi, in the University of Padua.

WILLIAM B. COLEY, M.D., of New York, Attending Surgeon to the New York Cancer Hospital; Assistant Surgeon to the Hospital for Ruptured and Crippled.

EUGENE R. CORSON, M.D., of Savannah, Ga.

GEORGE W. CRILE, M.D., of Cleveland, O., Professor of Principles of Surgery, Cleveland College of Physicians and Surgeons; Surgeon to St. Alexis's and Cleveland General Hospitals.

CHARLES GREENE CUMSTON, M.D., of Boston, Assistant Professor of Surgical Pathology, Tufts College Medical School.

B. FARQUHAR CURTIS, M.D., of New York, Professor of Clinical Surgery and Adjunct Professor of the Principles of Surgery in the University and Bellevue Hospital Medical College; Surgeon to St. Luke's Hospital, and to the New York Cancer Hospital.

HAYWARD WARREN CUSHING, M.D., of Boston, Surgeon to the Boston City Hospital.

GWILYM G. DAVIS, M.D., of Philadelphia, Surgeon to the Episcopal, St. Joseph's, and Orthopædic Hospitals.

HENRY PELOUZE DE FOREST, M.D., of New York, Assistant Pathologist to the Methodist Episcopal Hospital.

CHRISTIAN FENGER, M.D., of Chicago, Professor of Surgery in the Northwestern University Medical School.

WILLIAM H. FISHER, M.D., of Toledo, O., Professor of Clinical Surgery, Toledo Medical College; Surgeon to the Toledo Hospital.

CHARLES H. FRAZIER, M.D., of Philadelphia, Assistant Surgeon to the University Hospital; Surgeon to the Howard Hospital; Assistant Instructor in Clinical Surgery, University of Pennsylvania.

LEONARD FREEMAN, M.D., of Denver, Professor of Surgery in Gross Medical College; Surgeon to the Arapahoe County Hospital and St. Anthony's Hospital.

VIRGIL P. GIBNEY, M.D., of New York, Surgeon to the Hospital for Ruptured and Crippled.

CHARLES L. GIBSON, M.D., of New York, Surgeon to St. Luke's Hospital.

CHARLES H. GOODRICH, M.D., of New York.

BERTHOLD ERNST HADRA, M.D., of San Antonio, Texas.

A. E. HALSTEAD, M.D., of Chicago, Associate Professor of Surgery and Clinical Surgery in the Northwestern University Medical School.

WILLIAM S. HALSTED, M.D., of Baltimore, Professor of Surgery in the Johns Hopkins University.

W. BARTON HOPKINS, M.D., of Philadelphia, Surgeon to the Pennsylvania Hospital.

NEWTON JAMES, M.D., of New York.

WILLIAM JEPSON, M.D., of Sioux City, Iowa, Professor of Surgery and Clinical Surgery, Sioux City College of Medicine; Surgeon to St. Joseph's Mercy Hospital.

ROBERT JONES, F.R.C.S., of Liverpool, Honorary Surgeon, Royal Southern Hospital.

E. R. LECOUNT, M.D., Assistant Professor of Pathology in the Rush Medical College.

SAMUEL LLOYD, M.D., of New York, Attending Surgeon, New York Post-Graduate Hospital.

HOWARD A. LOTHROP, M.D., of Boston, Assistant in Anatomy, Harvard University.

CHARLES MCBURNEY, M.D., of New York, Surgeon to the Roosevelt Hospital.

STEWART LEROY McCURDY, M.D., of Pittsburg, Pa., Professor of Anatomy and Surgery, Pittsburg Dental College.

HENRY O. MARCY, M.D., of Boston.

JAMES E. MOORE, M.D., of Minneapolis, Professor of Clinical Surgery in the University of Minnesota.

BERKELEY G. A. MOYNIHAN, M.S. (Lond.), F.R.C.S. (Eng.), of Leeds, Assistant Surgeon, Leeds General Infirmary.

C. M. NICHOLSON, M.D., of St. Louis, Professor of Anatomy and Genito-Urinary Surgery, Beaumont Hospital Medical College.

LEWIS STEPHEN PILCHER, M.D., of New York, Surgeon to the Methodist Episcopal Hospital.

S. C. PLUMMER, M.D., of Chicago, Clinical Assistant in the Northwestern University Medical School.

CHARLES A. POWERS, M.D., of Denver, Professor of Surgery in the University of Denver; Surgeon to St. Luke's Hospital and to the Arapahoe County Hospital.

THEODORE PREWITT, M.D., of St. Louis, Professor of the Principles and Practice of Surgery and of Clinical Surgery in the Missouri Medical College; Surgeon to St. John's Hospital.

W. G. REYNOLDS, M.D., of New York, Assistant Surgeon to the Hospital for the Ruptured and Crippled.

MAURICE H. RICHARDSON, M.D., of Boston, Surgeon to the Massachusetts General Hospital.

JOHN D. RUSHMORE, M.D., of Brooklyn, Professor of Surgery, Long Island College Hospital.

W. E. SCHROEDER, M.D., of Chicago, Clinical Assistant in the Northwestern University Medical School.

NEWTON M. SHAFFER, M.D., of New York, Professor of Orthopædic Surgery, Cornell University Medical College.

JOHN I. SKELLY, M.D., of Pekin, Ill.

LEWIS A. STIMSON, M.D., of New York, Surgeon to the New York and Hudson Street Hospitals; Professor of Surgery, Cornell University.

ROBERT THOMPSON STRATTON, M.D., of Oakland, Cal., Surgeon to the Receiving Hospital.

A. H. TUBBY, M.S. (Lond.), F.R.C.S. (Eng.), Assistant Surgeon to and in Charge of the Orthopædic Department of Westminster Hospital; Surgeon to the National Orthopædic Hospital and to the Evelina Hospital for Sick Children.

JAMES P. WARBASSE, M.D., of New York, Assistant Surgeon, Methodist Episcopal Hospital.

JEROME HILTON WATERMAN, M.D., of New York, Assistant Surgeon to the Hospital for Ruptured and Crippled.

HENRY GOODWIN WEBSTER, M.D., of New York, Assistant Surgeon, Methodist Episcopal Hospital.

HENRY R. WHARTON, M.D., of Philadelphia, Demonstrator of Surgery, University of Pennsylvania.

HOWARD J. WILLIAMS, M.D., of Macon, Ga., Surgeon to the Macon Hospital; Lecturer on Medico-Legal Jurisprudence, Mercer University.

RANDOLPH WINSLOW, M.D., of Baltimore, Professor of Anatomy and Clinical Surgery, University of Maryland.



# ANNALS OF SURGERY.

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A CASE OF SUBCLAVIAN ANEURISM TREATED  
BY EXCISION OF THE SAC, WITH REMARKS  
ON THE LIGATION OF THE INNOMINATE  
ARTERY AND ON THE TREATMENT OF AN-  
EURISM.

By BERKELEY G. A. MOYNIHAN, M.S. (LOND.),  
F.R.C.S (ENG.),

OF LEEDS,

ASSISTANT SURGEON, LEEDS GENERAL INFIRMARY.

I HAVE recently had under my care a case of aneurism of the third portion of the right subclavian artery, which I treated by excision of the sac. A second aneurism developed about one inch internal to the ligature, and burst after the lapse of fifty-nine days from the operation. I then ligatured the innominate artery, but the patient died about an hour afterwards from hæmorrhage and shock. As the case seems to me to be an unusually interesting one and to present for consideration many points of interest, and as the surgical manipulations by which I removed the aneurism and ligatured the innominate are different from those usually recommended and approved, I have thought the completed history worthy of publication.

The following are the notes of the case, for which, and for his constant and assiduous attention to the patient throughout a grave and prolonged illness, I am indebted to Mr. F. E. Taylor, house surgeon.

H. S., married, aged thirty-one years, was admitted to the Leeds General Infirmary on October 6, 1897, on account of a

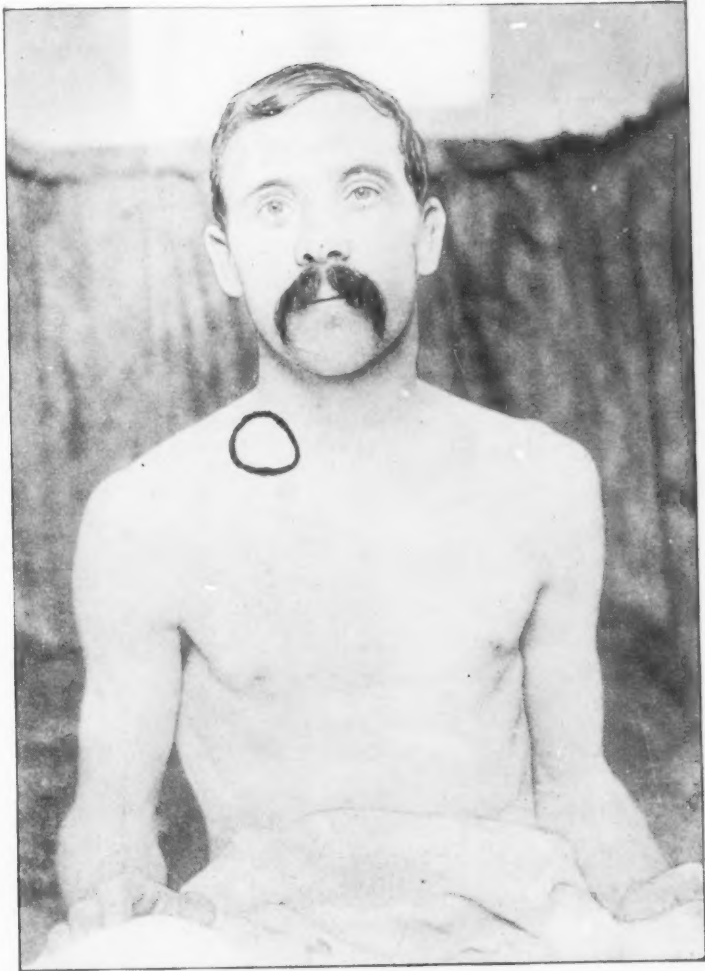
pulsating tumor in the root of the neck on the right side. (See photograph.) He gave the following account of his condition:

The tumor in the neck was first noticed while the patient was sitting at tea one Saturday evening about the end of August, 1896. On turning his head round rather suddenly he felt a sensation of "something giving way" just above his right collar-bone, but the wrench was a painless one. On putting his hand to his neck he felt a small lump, which could be covered by the tip of his finger, but there was no subjective sensation of throbbing, and he himself was only conscious of the lump, and of its pulsation, when the hand was pressed upon it. From this day the swelling underwent a gradual and progressive, though tardy, increase in size.

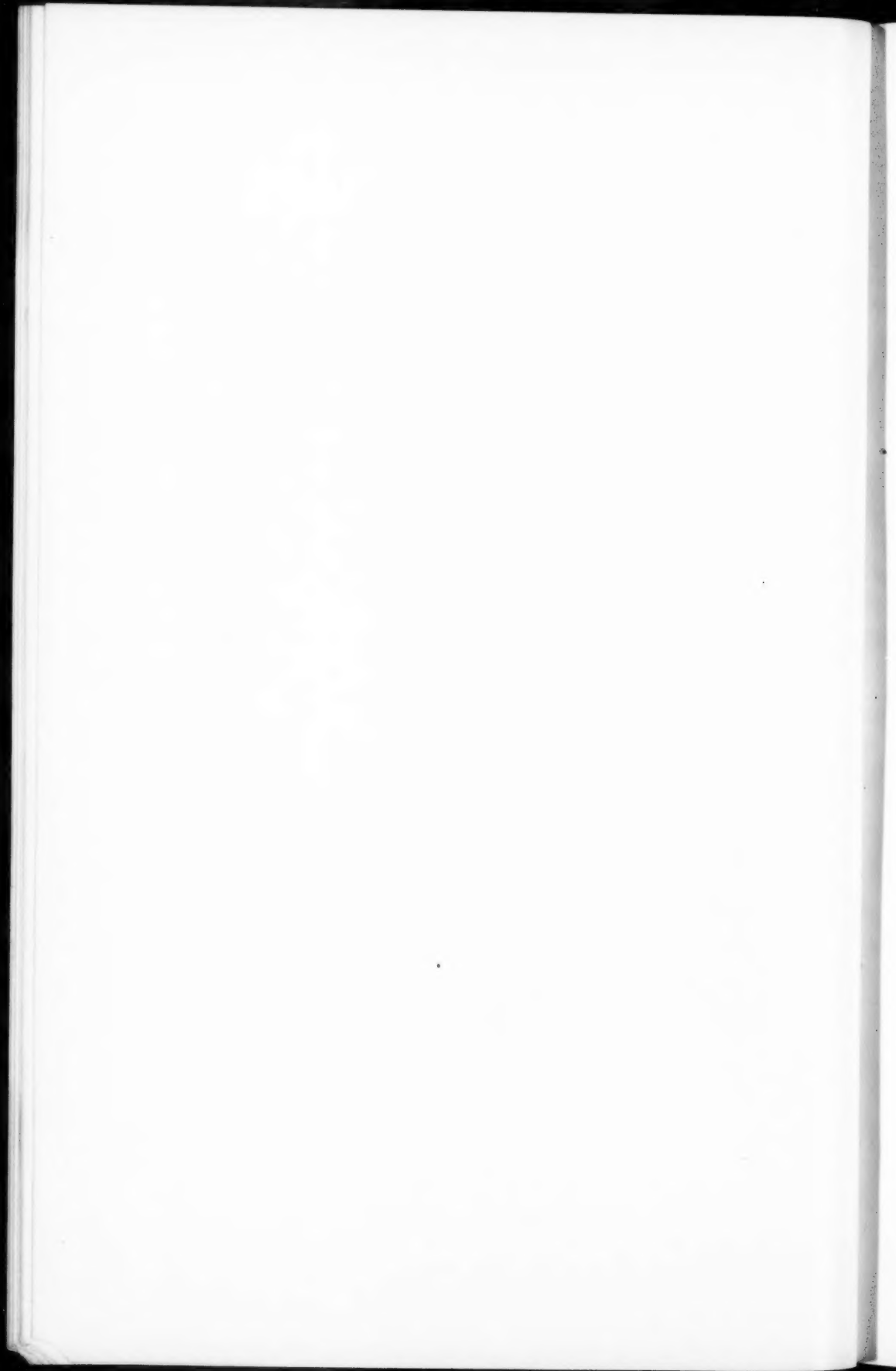
In July, 1897, the rate of increase seemed to be rather more swift, and in the month of September, for the first time, Dr. F. Walker, of Horbury, was consulted. The nature of the tumor was then recognized, and under Dr. Walker's directions the patient took to his bed, was placed on a low diet and given doses of iodide of potassium, commencing with fifteen grains, thrice daily. This treatment was continued for a little more than three weeks, with questionable result. The patient was then brought to Leeds by Dr. Walker, Mr. Moynihan was consulted, and the patient admitted forthwith to the infirmary.

There is a history of undoubted syphilis contracted at the age of seventeen. At his first examination Dr. Walker, on investigating the relative strengths of the radial pulses, discovered that the left radial and brachial pulses were absent, and that the whole left arm was slightly wasted, and of a "flabbier" tone than the right (the side of the aneurism). This history was then elicited. About six years before, when playing foot-ball, the patient had a severe fall onto his left shoulder, attended by much subsequent bruising. A gradually oncoming weakening and thinning of the arm was then noticed, and numbness and sensations of cold were complained of. The grasp in the left hand gradually weakened, and the whole arm pained and ached. By persistent massage the condition of the muscles was kept fairly good, and the arm, though feeble, was useful both for work and for ordinary purposes. How long the radial pulse had been absent could not be ascertained. On admission to the infirmary he presented this condition: Just above the junction of the inner and middle thirds





Photograph of the patient, showing the aneurism outlined with ink.



of the clavicle, on the right side, a tumor can be seen and felt to project from the deeper parts of the neck above the clavicle. The tumor (see photograph) is smooth and rounded, and appears to be about the size of a hen's egg. It is firm, though rather elastic, and pulsates, with an expansile impulse, forcibly, the pulsations being synchronous with the carotid pulse. On auscultation one can occasionally hear a distinct and characteristic bruit, though more often this is absent. The skin over the tumor is freely movable, and quite natural in appearance. The radial pulse, on the right side, is full and strong, and the vessel walls feel everywhere normal. On the left side the subclavian, axillary, brachial, radial, and ulnar pulses are all absent. The heart-sounds are normal, and there is no evidence of arterial disease elsewhere than in the upper extremities. A routine examination was made of all the organs, but nothing abnormal discovered. A scar on the penis at the site of the chancre is well marked.

The treatment was begun by ordering the patient fifteen grains of iodide of potassium thrice daily. He was to lie on his back, without a pillow: light diet was to be given, and all movement avoided. The iodide was increased until sixty grains were being taken thrice daily, and the patient carried out most admirably the instructions as to quietude. No change was noticed until October 29. On the morning of this day, while the nurse was washing his right arm, he suddenly complained that the forearm and hand had become numb and cold, and on examining them he found that the radial pulse could not be felt. The house surgeon was sent for, and on his arrival confirmed this observation. No pulse could be felt in either the radial or the ulnar, but was readily perceptible in the whole course of the brachial. Warmth soon returned to the arm, though the feeling of tingling and aching persisted for a few days.

On December 8, when the patient had been under treatment for two months, I could appreciate no change in the condition of the aneurism. After consulting with Mr. Jessop and Mr. Littlewood I decided to operate, and, for reasons which I shall give later, I preferred excision of the aneurism to ligature of the innominate or the first portion of the subclavian.

I had previously planned out and practised in the post-mortem room the operation which I intended to perform. It is a

procedure the like of which has not been, to my knowledge, suggested before, and as it gave me an ample field in which to work, and answered all my requirements with the completest satisfaction, I will describe it in detail.

Ether was administered. A curved incision with the convexity downward was made, commencing over the trapezius muscle internal to and above the acromio-clavicular joint and ending above and external to the sterno-clavicular joint, its lowest point being about one and a half inches below the centre of the clavicle. (See Figs. 1 and 2.) The flap thus marked out was reflected upward, and the full extent of the subclavian triangle

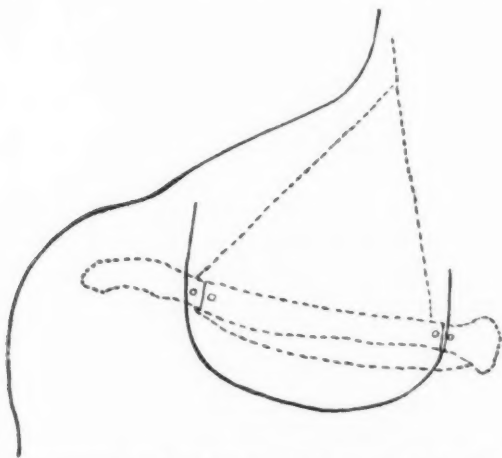


FIG. 1.—Showing the bony landmarks, the outline of the flap, and the position of the holes bored in the clavicle.

exposed. The outer half of the clavicular attachment of the sterno-mastoid muscle was divided about three-fourths inch above the clavicle, leaving sufficient of the muscle attached to the bone to enable the divided fibres to be readily stitched after the completion of the operation. The clavicle being cleared on its anterior surface four holes were now drilled through it, two about half an inch apart, at a distance of one and a half inches from the sterno-clavicular articulation, and two, the same distance apart, at the junction of the middle and outer thirds of the bone. Between the inner two and the outer two the bone was sawn through by Hey's saws, and the middle portion, attached by the subclavius muscle, liberated. Round the bone a large curved

Hagedorn needle, threaded with fairly stout silk, was passed, so that a loop of silk about two feet in length encircled the bone. On applying traction to this, the mid portion of the clavicle was pulled well downward and kept out of the field of the operation. This plan did away with the necessity of a retractor and of a hand to hold it, both of which would have been an encumbrance and an obstacle during the manipulations that were to follow. The aneurismal sac was now exposed and cleared, and the dissection

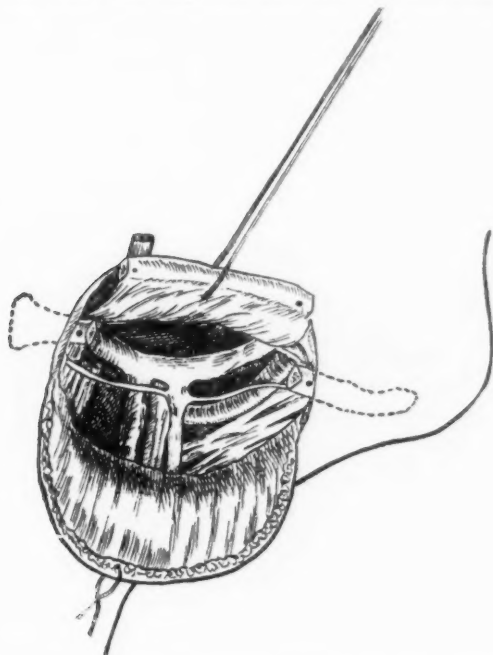


FIG. 2.—Showing the flap turned upward; the mid portion of the clavicle pulled down by the silk ligature, and the relative positions of the artery and vein.

to expose the outer edge of the anterior scalenus, and the artery beneath it, was commenced. As far as possible the fingers only were used in this part of the operation. After a little rather tedious clearing of parts, during which a vein was divided about one-fourth inch from its junction with the subclavian vein and ligatured, the scalenus anticus was well exposed. It was now seen that the aneurismal swelling began almost exactly at the outer border of the scalenus, and on raising this latter with a

retractor the second portion of the subclavian artery was readily exposed and seen. The subclavian vein and the pleura were both in close relation with the artery, but offered no difficulty in being gently separated and kept out of harm's way. The phrenic nerve lying on the scalenus was quite distinctly visible. There was now no difficulty in passing an ordinary aneurism-needle threaded with four strands of thoroughly well sterilized .00 catgut round the second portion of the vessel, and tying tight at a distance of about one-third inch from the aneurism. Between this ligature and the sac a thin silk ligature was passed and tied as close up to the sac as was possible. The subclavian artery was then cut through between these ligatures, and the aneurism freed on its inner side. All adhesions to the sac were now rapidly and very easily stripped away (the lowest cord of the brachial plexus being in especially close relationship to the tumor), and the dis-



FIG. 3.—The aneurism after removal, about two-thirds original size; *a*, the cut end at the junction of second and third portions of the subclavian artery; a glass rod distends the axillary end of the vessel.

section carried on till the first part of the axillary artery was reached. This was ligatured with catgut in the same manner as the subclavian, at a distance of about one inch from the aneurism, which was wholly subclavian. On cutting the vessel through internal to the ligature the aneurism was free, and was removed. (See Fig. 3.) During the later manipulations a second fairly large vein was wounded and ligatured, but the main trunk of the subclavian vein was unharmed. A few bleeding points were ligatured, the wound sponged dry, and the mid portion of the clavicle, freed from its silk retractor, replaced. Through the holes previously bored in the bone silver wire sutures were passed, and the loose middle fragment thus firmly fixed in position. The cut portion of the sterno-mastoid was sutured. A little loose iodoform-gauze packing was passed into the wound from the outer angle of the flap, and the skin wound united with interrupted

sutures of silkworm gut. At the end of the operation the patient's condition was excellent. He was put to bed and kept lying flat on his back, without pillows.

The day following the operation the temperature rose to 100.6° F. and ranged from 98.5° to 100° until the fifth day after operation, on the evening of which day the temperature suddenly rose to 104°. The skin in the neighborhood of the wound was bright-red and inflamed, paled on pressure of the finger, and had the appearance, but not the reality, of covering in and concealing a quantity of pus. The patient complained of headache and sickness. An incision about two inches long was made in the base of the flap, but no discharge followed. I think there can be no doubt that on this day and on the following days the patient went through an attack of erysipelas, the origin of which I was enabled to trace. Only a few drops of blood-stained serum oozed through the incision I had made. Hot boracic and salicylic fomentations were applied every two hours and general treatment adopted. On the evening of December 20 there was an escape of perhaps an ounce of blood, but a little pressure over the dressing arrested this. Until December 25 the temperature remained normal, but on this day it reached 101°, and on examining the wound a small collection of pus was found to be present beneath the incision I had made on the 14th. This was evacuated and the temperature returned to the normal. On this day I began the injection of antistreptococcus serum, as this wound I have just mentioned had obviously become infected, probably at the time of the changing of the fomentations. On January 9 a gland in the right axilla, which had been slowly enlarging, was incised and about two drachms of pus evacuated. From this day everything progressed most favorably. The wounds healed up well (the injection of serum had been continued), the patient's diet was very liberal, he ate well, slept well, gained obviously in weight and in general health, and expressed himself as feeling better and stronger every day. This happy state of affairs continued until February 6, the fifty-ninth day after the operation.

On this day the patient said that he felt "something burst" deep in his neck, and, immediately after, the flap I had raised in the operation was bulged out, and the incision made in it reopened, and blood trickled out. Digital pressure, and the subse-

quent application of a pad and bandage checked the hæmorrhage for the time, but on the morning of February 8 a fresh gush of blood occurred, the flap was more bulged than before, and there was evidently some large vessel opened. I therefore determined to open up again the subclavian triangle and deal appropriately with what I should find. Ether was accordingly administered. The incision through which the blood had oozed out was opened up, and the posterior triangle found filled with a large clot of blood. On speedily clearing this away a terrific hæmorrhage occurred from the lower and inner part of the subclavian triangle. On passing my forefinger down in this direction it entered, at a great depth, an aperture, into which the tip of my finger just fitted, in the subclavian artery. To reach this opening from the posterior triangle was quite impossible, and I therefore decided that my only hope lay in ligature of the innominate artery. This

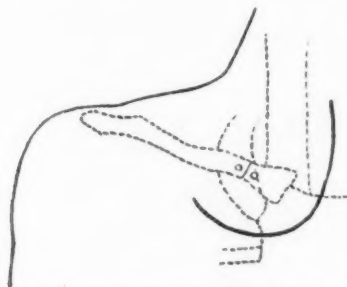


FIG. 4.—Showing bony landmarks and outline of flap.

operation I had also practised in the post-mortem room, and had convinced myself that the operation I shall now describe was the easiest, speediest, and most appropriate that could be performed. I consider that it has many advantages over the classical operation, and I think that any one essaying it on the dead subject will agree with me as to the practicability and ease of the method.

A curved incision is made with the convexity to the left, beginning about two and a half inches above the clavicle over the sterno-mastoid muscle, and terminating about two and a half inches below the clavicle, at, approximately, the junction of its inner and middle thirds. (See Figs. 4 and 5.) The incision extends to the left sterno-clavicular articulation. The flap so outlined is turned outward, exposing the sterno-mastoid, the inner end of the clavicle, the sterno-clavicular articulation, and a por-



tion of the upper end of the sternum. The clavicle is then pierced with two holes about half an inch apart, the internal one being at a distance of about one inch from the inner extremity of the bone. Between these two holes the bone is divided with a Hey's saw. A piece of the sternum is then outlined and removed by sawing or chiselling from the upper end of the cartilage of the first rib to the middle line of the bone, or a little beyond, and from the end of this incision a second is carried upward to the upper border of the sternum about its middle. The posterior surface of the sternum is cleared by passing the finger behind it. The inner end of the clavicle and the piece of the sternum are then turned upward, and access is readily given to the innominate artery just before its bifurcation. With reasonable

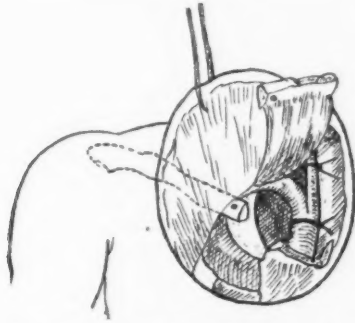


FIG. 5.—Showing flap reflected, the bones divided and turned up with sterno-mastoid. The point of division of the innominate is represented too high.

care, wounding of the pleura is easily avoided. A ligature can then be readily applied without the least difficulty, and with the confident assurance that no other neighboring structure is included in it. After the tightening of the ligature the bones are replaced. Silver wire or silkworm gut is used to unite and fix the divided clavicle, and the sternum is quite easily held in position by a few silkworm-gut or catgut sutures passed through its periosteal covering. Though my patient did not live to demonstrate the after-effects of this operation, there can, I think, be little doubt that all would heal satisfactorily and well, and that the bony union would eventually be complete and sound. That this procedure gives a more ready access to the innominate artery than any other operation described up to the present there can be

no question. It is a matter upon which any surgeon would soon satisfy himself by a single post-mortem room experience.

In performing this operation upon my patient I ligatured the common carotid and subsequently the innominate with fine silk. The hæmorrhage from the subclavian triangle ceased immediately on the tightening of the innominate ligature. At the end of the operation the patient was very profoundly collapsed, and in spite of transfusion, the injection of strychnine, and other attempts at restoration, he did not make any show of rallying, and died about one hour after the completion of the operation.

Only a limited examination of the body after death was permitted, but I was enabled to get all the essential parts away, and these are represented in Fig. 6. The arch of the aorta, the innominate, and common carotids with their ligatures, and the condition of the subclavian artery are well shown. The chief interest centres around the subclavian artery. At the point where my ligatures were placed it was firmly and completely closed and healed. Between this point and the origin of the vessel two distinct and wholly different conditions of the vessel wall are seen. Up to and including the orifice of the vertebral artery the inner wall of the vessel is quite smooth and normal in appearance, immediately beyond the opening of the vertebral the inner wall is roughened, irregular, and coated with a varying amount of disintegrating clot. The orifices of the internal mammary, thyroid axis, and superior intercostal are obliterated, and the trunks of these vessels were found to be cord-like and solid. About one inch from the ligatured extremity of the vessel, on the posterior wall, is an aneurismal sac about the size of a hazel-nut, into which the tip of the forefinger fits comfortably. The wall of this sac is ruptured, and it is this hole which I felt when my finger was passed deeply into the subclavian triangle at the second operation. It will also be observed that the arterial walls of the aorta and other vessels are in a state of advanced degeneration, syphilitic in character. It is not presuming too much, I imagine, to conclude that this second aneurismal dilatation, the rupture of which was the cause of death, is due to this profound and extensive arterial disease. I believe, therefore, that I am justified in assuming that with reasonably healthy arterial walls (especially so far as the first portion of the subclavian is concerned) my patient would, in all human probability, have recovered. Of this, however, I



FIG. 6.



feel completely satisfied, that all the parts immediately concerned in the first operation, the excision of the sac, were satisfactorily and soundly healed. The development of the second aneurism and its rupture are accidents, fatal ones it is true, but nevertheless accidents, and not in an average case needful to be reckoned with. And I feel therefore that the lesson to be learnt from the case is, on the whole, a lesson of encouragement, and of incentive to future similar efforts should the opportunity ever present itself.

The history of the treatment of spontaneous aneurism of the third portion of the subclavian artery is one of the saddest and most appalling chapters in the whole range of surgery. The most able and exhaustive account of the various procedures which have at different times been adopted has been published by Professor Edmond Souchon.<sup>1</sup> He has tabulated all the cases recorded up to 1896, and they number fifty-eight all told. Of these fifty-eight only eight cases recovered! The various methods of treatment adopted and the relative success of each may be estimated from the following grouping, which I have abstracted and epitomized from Professor Souchon's article.

Of the fifty-eight cases forty-three were treated by proximal ligature, three recovered, and these were—

CASE I (Green, 1844).—Ligature on third part of subclavian artery close to scalenus anticus.

CASE II (Coppinger, 1893).—Simultaneous ligature of the common carotid (which was divided between two ligatures, as advised by Aetius and revived, centuries later, by Abernethy) and innominate.

CASE III (Smyth, 1864).—Simultaneous ligature of the common carotid and innominate, and later of the vertebral. Return of the aneurism after ten years; opening of the sac, death, after forty-eight hours, from hæmorrhage.

Six were treated by distal ligatures,—one recovered.

CASE I (Monod).—Simultaneous distal ligature of the third portion of the subclavian and ligature of the common carotid. Pressure applied on the latter vessel before the operation had diminished the pulsations in an aneurism, which was very small.

Six were treated by amputation at the shoulder-joint,—two recovered.

Two were treated by opening the sac,—one recovered.

CASE I (Syme).—This is usually included, but the aneurism was subclavio-axillary and should be excluded from the list

CASE II (Smyth).—Alluded to above.

One was treated by excision of the sac and recovered.

CASE I (Schöpf,<sup>2</sup> of Vienna).—This case is so important that I quote it fully. It is, however, a case of subclavio-axillary aneurism and not purely subclavian. It merits, however, for many reasons inclusion here.

"Man, aged forty-six years; right subclavio-axillary aneurism of the size of a man's fist; is soft, yet elastic; no pulsation, no fremitus; upper extremity emaciated; movements limited and painful; no radial pulse; no oedema; no cyanosis, showing that the vein was free; trophic ulcer on the metacarpo-phalangeal articulation of the little finger of the size of a penny, communicating with the joint. It was thought that the tumor might be a neoplasm because the patient could not say if there had been pulsation, or if the tumor had been softer or compressible. Extirpation undertaken; is rather difficult as the entire brachial plexus was intimately adherent to the sac. The pectoral muscle was divided transversely; the portion of the artery on the distal side of the tumor was obliterated and contracted to the size of a lead-pencil; the central portion of the vessel was the size of the little finger, and was pulsating forcibly; it was ligated high up under the clavicle with strong silk; the axillary vein was separated with great difficulty without injury to its walls; finally, removal of the sac. It is a thick-walled aneurismal sac filled with firm blood-clots. Primary union; persistence of fistula for three months. Soon after the operation the ulcer healed with a good joint; pains and numbness disappeared, the use of the upper limb improved."

A case of excision of a subclavio-axillary aneurism has also been recorded by Dr. Halsted, of Baltimore, who has very courteously supplied me with an account of the case. As the treatment of this case was in principle similar to that in my own case, and as the result was the outcome of one of the most brilliant surgical achievements of modern times, I feel that it will not be out of place to quote the following brief abridgment of the original account.<sup>3</sup>

CASE.—L. W., October, 1852, colored man, admitted to hospital in April, 1892. Eight months ago noticed a small swelling underneath the clavicle, and he "could feel it beat like his heart" when he put his fingers on it. The tumor has grown rapidly. Patient worked till a month before admission, when the tumor was found to measure forty-two centimetres

in circumference at the base. The middle third of the clavicle was overlapped and almost concealed by the tumor, whose lower margin reached the fourth rib. To the touch the tumor was quite solid, but elastic, and it was not easy to feel the feeble pulsations. At the operation the subclavian artery was ligatured "as it emerged from the chest" (in the first portion therefore), in two places, by strong silk ligatures and the artery was divided between them. The aneurism, the greater part of the clavicle, a piece of the deltoid muscle, and about six centimetres of the subclavio-axillary vein were then removed in one piece. The axillary artery was ligated at the beginning of its second part.

The patient did exceedingly well after the operation, and sixty days after the operation it is noted that the wound had healed "in an ideal way."<sup>1</sup>

Totalling all these cases up, and omitting the case of Syme, which, as I have already explained, was a subclavio-axillary aneurism and therefore not admissible, and also the case of Schopf, we find that of fifty-six cases six recovered, fifty died.

One cannot refrain, on contemplating this ghastly list of tragedies, from repeating the oracular remark of Delbet, "*Ce n'est pas un chapitre de thérapeutique, c'est un martyrologe!*" But we cannot forget the indomitable efforts of the surgeons of all countries, during these last fifty years, in battling with this dreadful disease; one method after another has been tried, all without advancing our knowledge of the treatment the fraction of a step. Can we to-day see our way any clearer to the solution of the difficulty? May it not be that in excision of the sac, in complete extirpation of the tumor, lies the best method till now attempted of curing the disease? Until my patient was dead I was not myself aware of Schopf's case; and of Halsted's case I heard for the first time some six weeks after I had performed the operation. At the time I operated, then, I was of the opinion that my case was the first of its kind in the history of surgery,<sup>4</sup> and though it was eventually fatal, the death was, as will have been gathered by any one reading the notes, the result of what I am fairly justified in describing as an accident. All the parts immediately concerned in the operation were sound, and had it

<sup>1</sup> It is actually the first case of removal of a *true* subclavian aneurism.

not been for the extensive and advanced arterial disease, which culminated in the formation and bursting of the second aneurism, my patient would have been living to-day. But for purposes of argument, I think, it may be accepted that the story of the case from beginning to end goes very strongly to support, in the pursuance of my plea, the cases of Schopf and Halsted. With asepsis perfected, and some method of operation adopted similar to my own, I cannot but feel a confidence that the final word on this subject has yet to be spoken, the final chapter in this volume of surgery, as in how many others, has yet to be written.

The opportunity may, perhaps, be not inappropriate to discuss in this relation something of the history of surgery in the past. The more so as it is a history which is alluded to but seldom, and always inaccurately. It is, perhaps, more a subject of interest than of usefulness, but if credit for their work is to be given to the by-gone masters of our art, there is no reason why it should not be given justly, and, so far as we are able, be fairly apportioned to those who are most properly entitled to it. It will be of interest also to discuss the relative values of the different methods which by them have been inaugurated.

The operation of excision of the sac of an aneurism is very commonly, almost universally, referred to as the "method of Antyllus." Who Antyllus was, precisely when he lived and where he flourished, we have no means of ascertaining. All we know of him is contained in the works of Oribasius, the chief of whose writings was discovered in the Vatican in the year 1825. Oribasius lived in the fourth century, and in the fifth book of his works copious extracts are given from the writings of Antyllus. The following is the quotation of chiefest interest to us in this connection.<sup>5</sup> "We operate upon aneurysms of the extremities and the head in following manner. If the aneurysm be by dilatation, make a straight incision through the skin in the direction of the length of the vessel, and, drawing open the lips of the wound, divide with precautions the membranes which cover the



artery. With blunt hooks we isolate the vein from the artery and lay bare on all sides the dilated part of the vessel. After having introduced beneath the artery a probe we raise the tumor and pass along the probe a needle armed with a double thread. Cut the threads near the needle so that there be two threads. Seizing then the ends of the one thread we gently draw it towards one of the two extremities of the aneurysm and tie it carefully. In like manner we also bring the other thread towards the other end of the aneurysm and tie this in its place. Thus the whole aneurysm is between two ligatures. We open then the middle of the tumour by a small incision and in this manner all which it contains will be evacuated and there will be no danger of hæmorrhage. To extirpate the dilated part between the ligature is a dangerous operation."

From this it will be seen that Antyllus distinctly considers the operation of excision as contraindicated upon the ground of its danger. Philagrius, among the ancients, is said to have practised the operation of extirpation, but it was quite lost sight of until performed in the year 1699 by Purmann. By Delbet and other French writers the operation is consequently spoken of as the "*methode de Purmann*." Among contemporary surgeons Delbet<sup>6</sup> has, by his writings and his practice, done perhaps more than any other single surgeon to reintroduce and popularize the method, and to him I believe the largest share of any credit attaching to the operation legitimately belongs. In England my friend and colleague, Mr. Littlewood, has by his able and informative papers<sup>7</sup> been the most ardent and successful advocate, so far as my own knowledge goes. Both on the continent and in England, as well as in America, the method is now generally recognized as a classical and standard procedure.

Incision of the sac may be carried out in one of two ways, either after preliminary ligature of the vessel at each end, "the method of Antyllus," or the sac may be first incised and the entering vessel plugged with the finger until it is tied, as in the "method of Syme." Syme's operation can have little to recommend it in the present day. Its chief drawbacks are

the alarming hæmorrhage at the time of the operation, so alarming, in fact, as to bring the patient almost to the point of death in one of Syme's cases and in Smyth's classical case; the frequent, almost constant, onset of reactionary and secondary hæmorrhage from the vessels springing from the artery at or near the aneurism, the possibility of septic changes occurring in the sac, which is packed with gauze or lint, and, finally, the flavor of antiquity in the method itself which does not commend the procedure to the modern idea, except as a phase in the evolution of treatment.

The chief rival of the method of excision is, of course, the operation by ligature, the "Hunterian" operation, as we are pleased to call it. But here again I believe a vast amount of credit to be quite wrongly given. Our chief knowledge of what Hunter did, and his reasons for so doing, rest upon the testimony of Sir Everard Home,<sup>8</sup> a witness of the flimsiest character, upon whose testimony we are not likely to place much store of reliance. But for the moment, accepting what he says, we can only conclude that the reasons he assigns as animating John Hunter were based upon false and inaccurate observations, and that his arguments were, consequently, misleading and erroneous. Upon this subject I cannot do better than quote the words of Professor Stimson,<sup>9</sup> who says "Hunter's declared object was to tie the artery without opening the sac; to place the ligature at a point where the artery was likely to be healthy, thus to diminish the risk of secondary hæmorrhage; and, finally, if the latter did occur, to be able to place a second ligature upon the artery without having to make a second incision, or, as he says, without "breaking new ground,—a thing to be avoided, if possible, in all operations." Not a word is said in the account about collateral branches between the ligature and the aneurism, or about the sufficiency of diminishing the flow of blood instead of arresting it entirely, upon which so much stress was afterwards laid. In short, he was seeking only to make the current method of operating safer, and had no thought of introducing any new principle affecting the coagulation of the blood within the sac.

That this opinion of Professor Stimson's is correct any one reading the original account of the operation will, I have little doubt, admit. Hunter's reasons for choosing the femoral instead of the popliteal were chiefly three:<sup>10</sup>

(1) The femoral artery was less likely to be "diseased" than the popliteal.

(2) In case of secondary hæmorrhage a second ligature could be more readily applied.

(3) He "thought it highly probable that, if the parts were left to themselves, the sac with the coagulated blood contained in it might be absorbed and the whole of the tumor removed by the actions of the animal economy, which would consequently render any opening into the sac unnecessary."

Hunter's first operation was performed in December, 1785, and the incision was made "rather below the middle of the thigh." Four ligatures were applied, but "so slightly as only to compress the sides together." The operation of ligature of the femoral high up, in the triangle, was instituted by Scarpa, and the regions operated upon by the two surgeons are perpetuated in the anatomical text-books as "Scarpa's triangle" and "Hunter's canal." One fact of great interest to us in Leeds is that the notes of this first case of Hunter's were taken by his dresser at that time, the first William Hey, the Hey whose name is associated with the femoral ligament, the internal derangement of the knee-joint and other surgical conditions. These notes, which the late Mr. McGill once showed to me, have, very unfortunately, become lost.

The struggle for supremacy between these two methods, the method of excision and the method of distal ligature, is not unlikely to be a keen one, and, as the relative merits of the two are as yet by no means thoroughly sifted, it will, perhaps, be of service to state the comparative advantages of each. Much good work has been done in this direction by Professor Delbet. His first communication enumerated and contrasted the cases occurring up to the year 1888, and, in a further statement, he has examined and annotated the cases

recorded up to 1895. The points of comparison and contrast are chiefly these:

- (1) The mortality.
- (2) The recurrence after operation.
- (3) Gangrene.
- (4) The "quality" of the recovery.

(1) *The Mortality*.—Upon this point Delbet's statistics are most interesting and worthy of all attention. In 1888 the percentage death-rate of the two procedures was, of ligature of the larger vessels, 18.94; of excision of the sac, 11.32. Between 1888 and 1895, of ligature of the larger vessels (109 cases), 8.33; of excision of the sac (eighty-six cases), 0.00. Probably a larger proportion of cases of traumatic aneurism would be treated by excision.

(2) *Recurrence after Operation*.—This occurs in 5 per cent. of the cases after ligature. After excision, of course, it does not exist.

(3) *Gangrene*.—The proportion after ligature was, in 1888=7.58 per cent.; in 1895=8.25 per cent. The proportion after excision was, in 1888=2.94 per cent.; in 1895=2.77 per cent.

It is interesting to note that the statistics of the two series of cases, up to 1888 and from then up to 1895, are almost identical. It cannot be, therefore, that stricter antisepsics and the general advance in surgical methods have made any difference in the number of cases of gangrene. Gangrene, then, has nothing to do with the technique of the operation, is not dependent in any way upon the personal experience or ability of the operator. What are its causes? It is suggested in an editorial in the *Lancet*<sup>11</sup> that one cause may be that "in ligature the artery is occluded at two points,—namely, at the aneurism and at the point at which the vessel is tied,—while in extirpation the continuity of the artery is destroyed at only one spot,—namely, where the aneurism is situated;" an explanation which is not wholly satisfactory. Insufficiency of the collateral circulation is one, and the most spontaneous in our thoughts, of the likely causes, but it is a

matter of common knowledge that gangrene occurs after the lapse of many days,—ten, fifteen, or even more,—and in such cases a want of the enlargement of the anastomosing collateral vessels cannot be the cause. In such as these it is most probable that the gangrene is embolic, due to the carrying onward of clots formed, as a result of the ligature, in the sac, or perhaps between that and the occluded point. The newly developed or enlarged anastomoses bring to the vessel on the distal side of the ligature a stream of blood sufficiently strong to carry forward in its current one or more, perhaps a shower, of small broken-down fragments of clot which block the lumen of the smaller vessels when these are reached. If this explanation is correct, and it is at least a plausible one, it would afford an argument also in favor of extirpation of the sac as against ligature. If the sac be removed, the chief nest of these small embolic clots is withdrawn, and the possibility of subsequent gangrene reduced to a minimum. But more than this. In the case of ligature of vessels it is, I suppose, an accepted truth that the further the ligature from the aneurism the more likely is gangrene to follow, and, conversely, the nearer the ligature the less likely. If, then, the sac is excised the deligated point is within an inch or so of the sac, and consequently the rudiments of the collateral circulation are much less likely to be interfered with. From this point of view, then, and accepting these reasonings, there can be no manner of doubt that the argument favors the more radical method of treatment; gangrene being about three times more frequent after ligature as after extirpation.

(4) "*Quality*" of the Recovery.—The trophic disturbances seen in connection with aneurismal swellings are due, not so much to the mere pressure on nerve-trunks, as to the actual involvement and embedding of the nerve in the adventitious wall of the sac. Delbet has referred to cases where, after the operation of ligature, the aneurism being "cured," amputation of the limb was necessary, owing to the persistence of trophic disturbances, and to others where, after similar operations, the member remained a palsied and a useless

one. If the sac is removed without immediate danger to the nerve, these neuropathic troubles, trophic changes, palsies, and pains would in all likelihood disappear.

A patient, then, subject to excision of the sac as compared with distal ligation has (1) a far greater chance of recovery from the operation; (2) no risk of recurrence; (3) a far less risk of gangrene; (4) a probable complete recovery from any of those affections due to nerve interference.

It is not unlikely, therefore, that in the next few years the operation of excision will increase in general favor, and will be performed in a larger number of cases than heretofore; and it is not unwise to predict that in a very large proportion of cases of aneurisms of all kinds it will be, by the vast majority of surgeons, the operation of their choice.

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## CURVATURE OF THE NECK OF THE FEMUR, SOMETIMES CALLED "COXA VARA."

By CHARLES H. FRAZIER, M.D.,

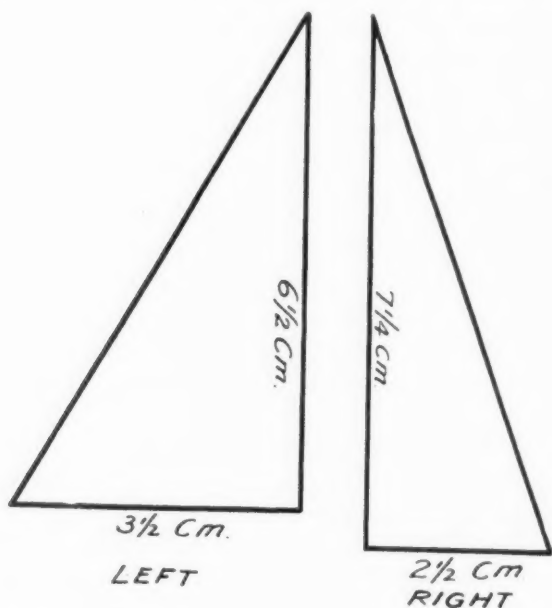
OF PHILADELPHIA,

ASSISTANT SURGEON TO THE UNIVERSITY HOSPITAL; SURGEON TO THE HOWARD  
HOSPITAL; ASSISTANT INSTRUCTOR IN CLINICAL SURGERY,  
UNIVERSITY OF PENNSYLVANIA.

*Introduction.*—My interest in this subject was first aroused when an opportunity to make some personal observations offered itself, the subject being a patient in the Surgical Clinic of the Howard Hospital. The history of the case is as follows:

CASE I.—A girl, nineteen years of age, about nine years ago began to be annoyed by vague pains in her limb, especially in the right hip, and shortly afterwards she noticed that she limped slightly. At times she would have mild exacerbations of pain, which lasted for a week at a time, but at no time was it severe enough to confine her to bed. She complained especially after a hard day's work, her occupation consisting in doing general work on a farm in Ireland; such work as would ordinarily be allotted to a man. She presented herself for treatment simply on account of her lameness, for now she suffered no pain. If she had been particularly active during the day, the affected limb would be more fatigued than the unaffected one. There was no history of trauma. Examination showed the right trochanter to be elevated  $4\frac{1}{2}$  centimetres above Nélaton's line, which passed over the tip of the left trochanter. The base of Bryant's triangle, on the right side, measured 3 centimetres, on the left 7 centimetres. The trochanter was displaced backward as well as upward. The pelvis slightly inclined to the right. The circumference of the right thigh was  $49\frac{3}{4}$  centimetres, the left  $52\frac{3}{4}$  centimetres. Inward rotation and abduction were restricted

and flexion beyond 90 degrees was impossible, and was accompanied with adduction of the limb. The girl was exceptionally robust, of large bony frame, good muscular development, and presented no evidences of rickets. A diagnosis of curvature of the neck of the femur was made, which was confirmed by a skiagraph of the hip-joint, taken by Dr. Goodspeed, revealing the head of the bone in its normal position, but a marked deformity of the neck. (See skiagraph.) Inasmuch as there was only slight interference with the motion of the joint, and no pain, there was no indication for any course of treatment. The



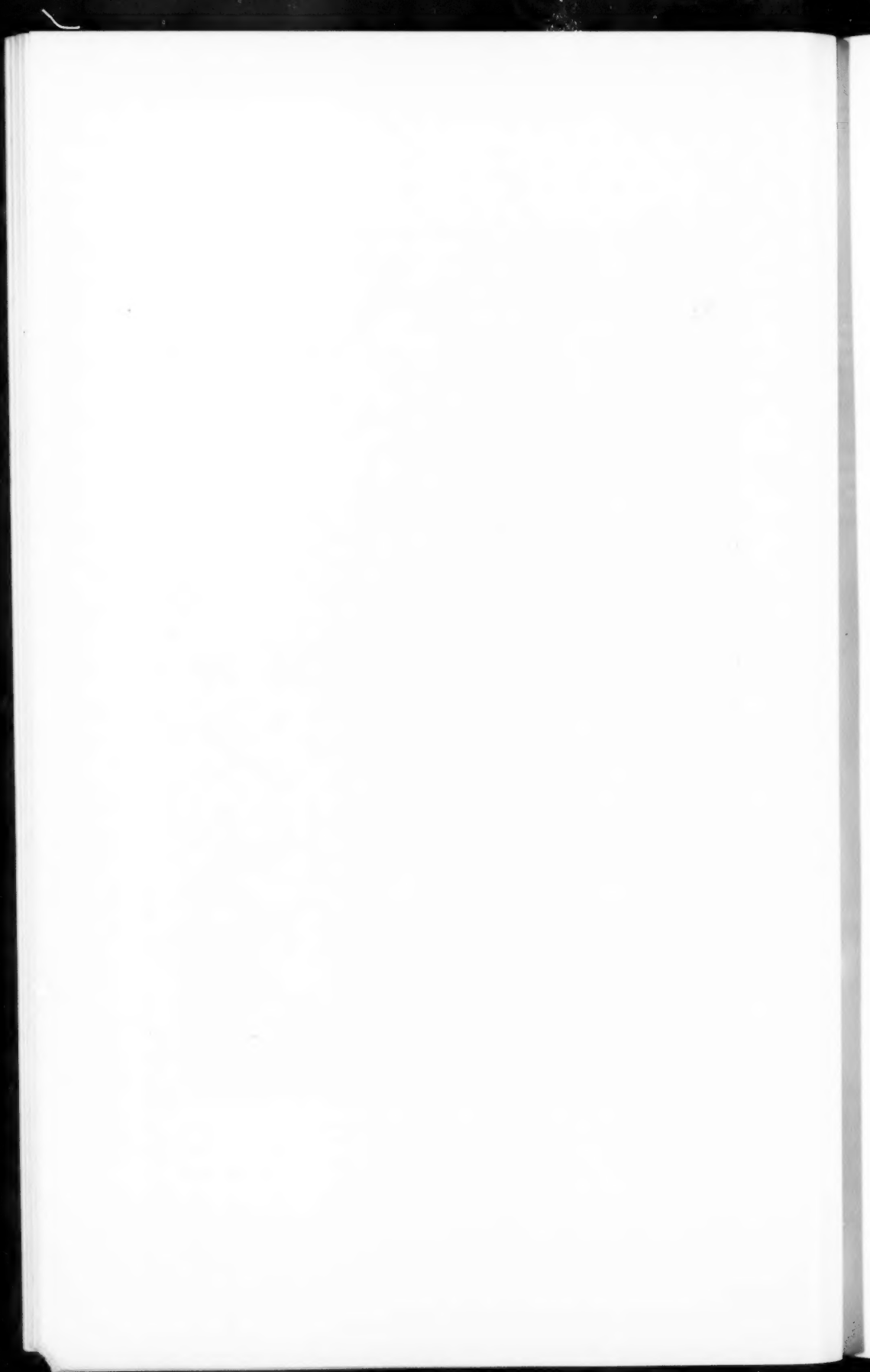
patient was advised to provide herself with a high sole to be worn on the shoe of the affected side, to make up for the shortening, and thus improve her gait. It is highly probable that at the age now attained by the patient there will be no increase in the deformity, and therefore no necessity for restricting the use of the limb.

CASE II.—A child, eight years old, of German extraction, with a family history free from any hereditary taint that would have any bearing on the disease. About two years ago the child fell, but suffered no immediate inconvenience. Later on the





Skiagraph of the author's case.



mother noticed that the child in romping became more easily fatigued in the right limb than in the left. Such has been the history for the two years intervening between the fall and the present time. The child was admitted to the Surgical Ward of the Home for Crippled Children, and an examination revealed the following condition: The pelvis slightly inclined to the right; the right trochanter was 1 centimetre higher than the left, the base of Bryant's triangle measuring  $3\frac{1}{2}$  centimetres on the left side and  $2\frac{1}{2}$  centimetres on the right. The right trochanter was displaced somewhat backward as well as upward. The distance from the anterior superior spine to the external malleolus on the right side measured  $55\frac{1}{2}$  centimetres, on the left  $56\frac{1}{2}$  centimetres. The circumference of the right thigh was 33 centimetres, of the left 34 centimetres. The sulcus between the trochanter major and the nates was deeper on the right side than on the left. Passive motion was absolutely painless, but very much restricted. Flexion was almost entirely restricted. Inward rotation was not possible beyond a point where the foot pointed directly forward. Any attempt at flexion was accompanied with external rotation. In no way could pain be elicited either by direct or indirect pressure on the joint. In other respects the child was well developed. In walking she limped, favoring the right side.

Dr. Goodspeed kindly took a skiagraph for me, which reveals the following condition: On the affected side the angle of the neck is less obtuse than on the unaffected side. The distance between the tip of the trochanter major and anterior superior iliac spine is greater on the right than on the left, showing a displacement upward of the trochanter on the affected side. These facts correspond with the result of the examination as above described. Under complete anæsthesia the movements of the joint were found to be restricted, but to a less degree than above noted. Flexion was possible to 90 degrees, inward rotation and abduction were limited, and outward rotation abnormally free. This case illustrates well the fact that muscular rigidity is oftentimes responsible in these cases for some of the restricted motion.

*Nomenclature.*—The Germans have variously termed this affection "*Verbiegung*" or "*Verkrümmung des Schenkelhalses*,"

and "*Coxa Vara*," while in English literature we meet with the terms "bending" and "incurvation of the neck of the femur." Of the two latter terms, incurvation or curvature seems to me to be the most descriptive, implying, as it does, that the neck is actually curved, while the term bending might imply simply an alteration in the angle. There has been considerable dispute among the Germans over the adoption of the term "*coxa vara*," a term which, however, is used almost exclusively. Without entering into the details of the discussion, it has been generally acknowledged that the common interpretation of the term "*vara*" applies to only one of three recognized groups of this affection, and that therefore the phrase "*coxa vara*" should not be employed as embracing all the manifestations of this deformity. For this reason, and in order to avoid confusion and simplify matters, I should recommend the adoption of the term "incurvation" or "curvature of the neck of the femur" for all cases.

*History.*—Though the deformity of the upper extremity of the femur, known as incurvation of the neck of the femur, had been recognized and described as early as the middle of this century, it has not been until within the last decade that it has been the object of special study. As early as 1851 Zeis demonstrated a specimen showing distortion of the femoral neck, without any evidence of disease, and two years later Roser described a specimen, obtained at the autopsy of a patient, who died of phthisis, in whom a diagnosis of luxation of the hip-joint had been made ante-mortem; the post-mortem revealed the fact that the head was not displaced from its normal position, the distortion of the neck being accountable for the deformity. Later on, in the year 1857, Dr. Richardson exhibited a specimen, obtained from the dissecting-room of the Medical Department of the Pennsylvania College, showing deformity of the neck and head of the femur, which might have been mistaken for osseous union following intra-capsular fracture. The neck was so deformed as to form with the shaft an angle of 45 degrees, and, in addition, was shortened and increased in its antero-posterior diameter. Rich-

ardson regarded the deformity as a manifestation of rickets, although the remainder of the skeleton gave no further evidence of it. In 1886, Dr. Monks, of Boston, reported a case of "universal deformity of both hip-joints," which undoubtedly belongs to this category, but was considered by the author to be a manifestation of arthritis deformans. The patient was sixteen years of age, of German extraction, with no traces of rheumatic or other articular affections running through the family history. The onset of the disease began two years previously, with pain and stiffness in the right hip, involving in the course of three months the left hip. The thighs are recorded as being rotated outward, the trochanters displaced upward, the heads of the bones being considerably lower than the trochanters; motion in both hip-joints was decidedly limited; and as a consequence the gait was affected, the patient rocking the body from side to side as he walked. Associated with these symptoms were bilateral knock-knee and flat-foot, and poorly developed muscles of both thighs. This case was evidently one of "bilateral curvature of the femoral neck," and is referred to simply as an instance of how recently the disease passed unrecognized. Keetley, of London, had under his care, in 1888, a case exhibiting this deformity. Not until the parts were exposed at the operation, at which he removed a cuneiform section of the femur, was the true nature of the deformity appreciated. On account of the scoliosis, which was also present, the history of slow development, and the presence, in the specimen excised, of such pathological changes as one meets with in rickets, the case was regarded as one of rhachitis adolescentium, in spite of the fact, as Keetley himself admitted, that he had never seen a case of rickets in young adults in which the upper extremity of the femur alone had been attacked. This brief history brings us up to a period when incurvation of the femoral neck first began to be recognized as a deformity with definite clinical signs. To the writings of Hofmeister and Kocher we are indebted for a large portion of all the information which literature furnishes us on this subject. At the present day

the clinical manifestations are clearly understood, and may readily be recognized if one be familiar with them. The modern text-books, however, in many cases do not even mention the subject; while others treat it so superficially that it is my impression that, generally speaking, the medical profession at large are not very, if at all, familiar with even the fundamental facts, and in many cases are not even conscious of the existence of such a deformity. To those who have given it the most careful study the subject still presents many difficulties, and there are many points over which there is still some discussion. As mentioned above, the clinical manifestations are now clearly understood by those who have made it their special study; so, too, are the pathology, the nature, and the mechanism of the deformity, and, perhaps, the treatment. The exact etiology of the disease, however, is still a mooted question. When one considers that but few specimens have been obtained from authentic cases, an explanation at once suggests itself, which will account for the still somewhat indefinite knowledge of certain phases of the subject. Since the valuable and exhaustive papers of Hofmeister and Kocher (in 1894) but little that can claim originality has appeared in literature. Hofmeister in 1894 collected and tabulated some forty cases, all that had up to that time been reported, and from that to the present the writer has been able to gather from literature about forty more. It is not the object of this paper to advance new theories or to furnish original ideas, except in so far as a careful study of the data furnished by those forty additional cases may throw some additional light on one phase or the other of this subject, or may modify somewhat the clinical picture as handed down to us from the earlier writers. The aim of this paper is rather to present the subject in such a way as can be made possible only by a comprehensive study of all the literature pertaining thereto.

*Clinical Picture.*—The earliest manifestations of this deformity make their appearance rather insidiously, usually at the beginning of adolescence, frequently without any apparent cause, exceptionally following some slight traumatism.

The young patient, it will be found, is usually following an occupation that requires him to be on his feet continuously during working hours; it is often his duty to carry heavy weights. The very first thing he notices, perhaps, will be that he is more easily fatigued now than aforesaid; a task which he could formerly perform without any sense of fatigue now wearies him. This slight inconvenience, however, is overlooked; he continues with the same daily occupation, but soon becomes conscious of vague pains about one or the other hip-joint; he is told they are growing pains and a liniment is prescribed. The pain, however, becomes severer, and soon he begins to limp, as a result of the shortening. Finally he finds that the motion of the joint is more or less restricted, he is unable to stoop over, and cannot assume the sitting posture without difficulty. This is the clinical picture of a moderate case. The time required for these symptoms to become so aggravated that the patient seeks medical advice varies. It may be one year or it may be many more, as in the author's case; as a matter of fact, in thirty-five out of seventy-five cases the patient came under the physician's observation within two years of the onset of the disease. There may be certain variations from the typical case, as above described. In some pain is the predominant symptom, the functional activity of the joint being limited but to a slight degree, and again in others the condition is reversed. The pain, as a rule confined to the region of the hip, but occasionally radiating to the knee, is of rather a dull aching character, quite unlike that accompanying inflammatory diseases of the bones and joints. It is present when the patient is in active motion, walking or running, or simply in changing his position, as, for example, from the standing to the sitting posture. In a certain proportion of the cases, if the limb be allowed to remain in one position for any length of time, there will be some stiffness noted immediately on any attempt at motion. The alteration in gait depends upon several factors. Primarily the patient limps because one limb is shorter than the other, as a consequence of the bending of the femoral neck; later on, however, the restricted

motion in the joint is an additional factor. The greater the shortening and the more restricted the articular motion the more conspicuous the limp. When the affection is bilateral, which was the case in nineteen out of seventy-four cases, the gait is quite characteristic, and has been termed the waddling gait; the patient swings one leg in front of or across the other as he walks, his body swaying from one side to the other. Of course, there is a great variation in the degree of deformity, and consequently in the subjective disturbances. Some cases will be able to go on for years, regarding the deformity as but a slight inconvenience, while others are dependent upon crutches for locomotion or perhaps may be altogether bedridden. Occasionally the course of the disease will be interrupted with periods, when there will be an almost complete subsidence of the symptoms, the latter reappearing on the occasion of some slight trauma.

*Objective Symptoms.*—An examination of the patient will reveal further interesting facts. There is *usually* no relation between the physical development of the patient and the deformity. We find it as well in those who are well nourished, of large bony frame, and good muscular development as in those in which these conditions are reversed. In a certain number of cases the skeleton has not developed commensurately with the muscular tissue, and again in others there seems to be a general loss of muscular tone.

Atrophy of the muscles of the thigh on the affected side will be present in every case to a greater or less extent, according to the amount of functional disturbance of the joint and the duration of the affection. In some cases the difference in circumference between the two thighs will amount to seven centimetres. Hofmeister has called attention to a phenomenon that has not infrequently been noticed (a condition which Mikulicz refers to in his work upon the lateral deformities of the knee),—namely, the bluish red discoloration and chilliness of hands and feet on standing for any length of time with the arms hanging. An examination of the affected hip will recognize a dissimilarity in contour existing between



that and the sound one. This is due to the prominence of the trochanter, one of the most constant and most conspicuous objective signs. The trochanter major is almost without exception displaced upward, in many cases both upward and

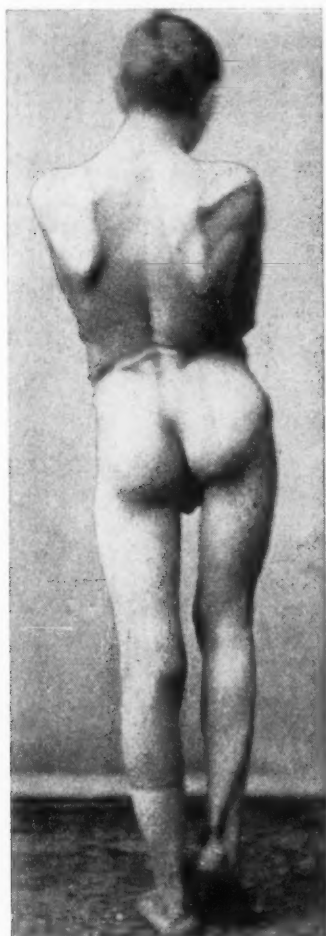


FIG. 1.—Showing prominence of trochanter. (Whitman's case.)

backward, and in not a few cases upward and forward. The displacement upward of the trochanter is accounted for by the bending of the neck on the shaft, so that the obtuse angle normally existing between the two is converted into a right

or more frequently an acute angle. If at the same time the neck is twisted on its long axis, either forward or backward, the displacement upward and forward or upward and backward is thus explained. The prominence of the trochanter is exaggerated by the muscular atrophy, which was referred to above. It is not rare to find between the trochanter and the prominence of the buttock a deep sulcus. (Fig. 1.)

This prominence of the trochanter can also be accounted

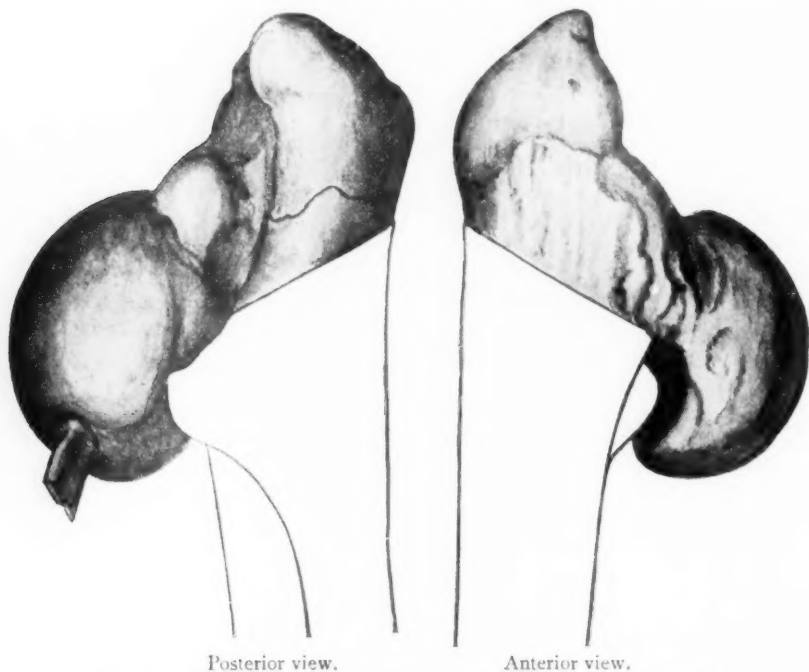


FIG. 2.—Showing deformity of neck. (From the specimen of Schultz.)

for by the elongation of the upper border of the neck of the femur, which takes place as a consequence of the arching of the neck,—a condition easily demonstrated by an examination of a specimen. (Fig. 2.)

The attitude which the affected limb maintains is quite conspicuous and quite characteristic; of sixty-eight cases in which the position of the limb was mentioned, in forty-three the position was that of outward rotation, six outward rota-

tion and adduction, in five outward rotation and flexion, in two inward rotation and adduction, in one adduction, and in one adduction and flexion. In eight the position was normal. Since, therefore, of sixty cases, in which the position of the limb was abnormal, outward rotation was present in fifty-four, we may look upon this unnatural position of the limb as an almost constant feature.

TABLE I.

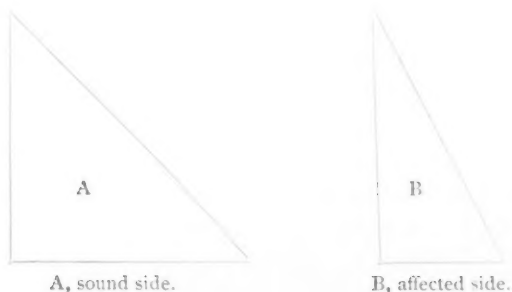
Position of Limb.	Hofmeister.	Frazier.	Total.
Outward rotation . . . . .	27	16	43
Outward rotation and adduction . . . . .	1	5	6
Outward rotation and flexion . . . . .	0	5	5
Inward rotation . . . . .	1	1	2
Inward rotation and adduction . . . . .	1	1	2
Adduction . . . . .	0	1	1
Adduction and flexion . . . . .	1	0	1
Normal . . . . .	5	3	8

The actual displacement of the trochanter major is easily determined by Nélaton's line, which, as is well known, normally passes over the tip of the trochanter; in the deformity with which we are dealing the trochanter occupies a position from one to seven centimetres above this line.

TABLE II.

Centimetres above Nélaton's Line.	Number.
One centimetre above . . . . .	11
Two centimetres and a fraction . . . . .	27
Three centimetres . . . . .	19
Four centimetres . . . . .	11
Five centimetres . . . . .	4
Six centimetres . . . . .	1
Seven centimetres . . . . .	3
Not stated . . . . .	12
Average . . . . .	2.7

Comparing Bryant's triangle in the sound with that in the affected side, in my own case, the dissimilarity is quite remarked.



To continue with the objective manifestations consequent to this bending of the femoral neck, there remains to be discussed the shortening of the limb, tilting of the pelvis, and compensatory scoliosis. Shortening of the limb naturally follows any approach to a right or an acute angle between the neck and shaft, and the degree of shortening is easily estimated by measuring from the anterior superior spine to the tip of the internal or external malleolus. Tilting of the pelvis and the compensatory scoliosis are natural sequelæ of the shortening.

The clinical picture would be incomplete without a reference to the limitation of motion, both active and passive, in describing which I will follow Hofmeister, who divides the cases into three general groups.

GROUP I.—Elevation of the trochanter and limited abduction are the characteristic features. The attitude of the limb is usually normal, flexion and rotation being either normal or limited to a slight degree.

GROUP II.—Elevation of the trochanter and outward rotation. In addition to the limited abduction, associated with cases in Group I, we find in this group that inward rotation is so restricted that it is impossible to rotate the limb farther inward than to a position in which the foot points directly forward. Outward rotation may be possible only to a normal degree, or so far beyond the normal that the patella and foot may point not only directly outward but backward. Abduction and adduction are as described in Group I, the former being markedly restricted or altogether abolished, the

latter entirely free. In the majority of cases flexion is unrestricted, except when attended with outward rotation and adduction of the thigh,—that is to say, if one attempts to flex the limb, he must at the same time adduct it and rotate it outward, or he will soon come to a point where further flexion is restricted. If the affection is bilateral, it is now easily understood why, when both thighs are flexed simultaneously, each leg will cross over its fellow. (Fig. 3.) The appearance of



FIG. 3.—Whitman's case.

such a patient is also quite characteristic, and it is commonly spoken of as the "scissor-legged deformity." The gait is not unlike that seen in cases of bilateral congenital luxation of the hip.

Through the co-operative effect of outward rotation and limited abduction in bilateral cases there exist certain characteristic restrictions in the movements of the legs. For example, such a patient can kneel only with the legs crossed. The explanation of that is apparent: flexion is only possible when the limb is rotated outward, and spreading of the thighs (which would obviate the necessity of crossing the legs) is

quite impossible, since abduction is restricted. For the same reason sitting on a stool with legs close together is impossible, and stooping over to pick an object off the ground is difficult. The *rationale* of this will be appreciated when, by voluntarily limiting abduction and rotating the limb outward, we try in our own persons to touch the floor with our hands. Such an act is only made possible by the preternatural mobility of the vertebral column. Of the three groups the large majority of cases belong to Group II; of fifty-five cases tabulated by Hofmeister, forty-four belong to this group, eight to the first and three to the last, now to be described.

GROUP III.—Elevation of the trochanter and inward rotation. The functional disturbances of this group correspond with those of Group II, with this exception, namely, in one we find inward and in the other outward rotation.

Kocher adds to this picture the extended position that the limb frequently occupies in this deformity. He believes too little stress has by others been laid upon this point, for upon its recognition will depend, in a measure, a thorough understanding of the development of the deformity.

*Mechanism.*—With the picture of this restricted functional activity of the joint fresh in our minds, a discussion of the mechanical principles here involved naturally follows.

(1) The limitation of abduction is perhaps the most easily explained. The direction of the neck is so changed in this deformity that the head is already in a position which it normally occupies when the limb is markedly abducted. Thus the excursion of motion in this direction has been entirely completed by the head and neck before an attempt to abduct the limb has been made. Whitman suggests another factor to account for limited abduction. The trochanter major is displaced so far upward that abduction is prevented by the trochanter striking against the ilium. When the inferior border of the neck becomes shortened by this curvature, the head is approximated so closely to the trochanter minor that any attempt at motion in the direction of adduction will force the trochanter minor against the head of the femur, and thus

limit adduction (Schultz's and Müller's specimens show this shortening of the under surface of the neck). The interference with rotation is in a measure due to the increase of the diameter of the neck from before backward, so that the neck impinges upon the acetabular rim when the limb is rotated. To explain the increased range of external rotation and the decreased range of internal rotation, Hofmeister constructed a model by sawing off the neck at right angles to its axis and attaching it again to the shaft in such a way that its relationship to the shaft corresponds to that found in this deformity. If now both femoral shafts are put in such a position that the patellæ are looking directly forward, or, in other words, in a position midway between inward and outward rotation, and the femoral heads are examined, on the normal side will be found as much articular cartilage exposed as is natural with the limb in this position; but on the pathological side but a narrow strip of articular cartilage will be exposed, only so much as would normally be found if the limb were in a position of inward rotation. This may be expressed in another way: While the head maintains its position normally present, when the limb is midway between inward and outward rotation, the shaft, owing to the backward bending of the neck, is at the same time occupying a position of more or less pronounced outward rotation. Consequently, when we attempt to rotate the limb inward, on reaching a point about midway between external and internal rotation the head has already reached the position of internal rotation, consequently further motion in that direction is limited. On the same line of reasoning it can be clearly understood why external rotation is apparently increased. As a matter of fact, the arc of rotation is, as a rule, less on the pathological side than on the sound side. It will be recalled that, in referring to the functional limitations of the joint, mention was made that oftentimes flexion was only possible when accompanied by external rotation. When the limb is moved in the direction of flexion (involving a revolution of the neck on its longitudinal axis) the articular surface of the head will soon

disappear in the acetabular cavity and the neck will impinge on the rim of the acetabulum, thus offering a mechanical obstruction to further flexion; if, now, the limb be rotated outward, the articular surface of the head will reappear from the cavity and further flexion rendered possible.

Before discussing the cause of the curvature and alteration in the angle of the neck of the femur, it will not be out of place to note some of the observations of Humphrey in the normal angle of the neck at different periods of life under various circumstances. (1) The angle varies considerably in different persons at given periods of life. (2) The angle naturally decreases during the period of growth (from foetal to adult life), but that after growth has been completed it does not usually undergo any change, even if life be continued to extreme old age. (3) During the period of growth if the limb be relieved from the weight of the body, as in the bedridden state, in paralysis or in a stump, the angle of the neck with the shaft usually retains the obtuse form of early life or may even become more obtuse.

*Etiology.*—The causation of this affection is a question which has provoked much discussion and speculation, and it has not yet been definitely settled just what the lesion is which, localized in the neck of the femur, permits of its yielding. There exist, no doubt, certain pathological conditions that would account for such an occurrence, as, for example, osteomalacia, chronic osteitis (tubercular, perhaps), arthritis deformans, or rickets. In fact, cases representing each of these have been published; Maydl reports two cases in which the specimens he resected were typical of arthritis deformans; Hofmeister reported a case of bilateral coxa vara, with all the characteristic functional disturbances, in a woman with advanced puerperal osteomalacia; Lauenstein's historic case, reported in 1888, gave evidence of marked rhachitic deformities in many of the long bones. Despite these examples, there exists a certain number, constituting no mean proportion of all the cases, in which the exact nature of the deformity has been recognized during life, but in which there were no



demonstrable lesions either of osteomalacia, rickets, or arthritis deformans. It is more with reference to this particular class that the determination of the etiology still remains unsettled. (Before proceeding further, it is better for our purpose to divide the cases into three groups,—the congenital, the infantile, and the adolescent.) This condition of uncertainty is partly to be accounted for by the trifling number of specimens that have been secured for examination, and when this number increases sufficiently to allow of a more thorough study, both macroscopically and microscopically, the final report of the pathologist may suggest the key to the situation. The number of specimens thus far obtained that furnish the material for our speculations is only 16: of these Kocher furnishes 2; Müller, 1; Lauenstein, 1; Richardson, 1; Rotter, 1; Schultz, 1; Kirmisson, 4 (the femoral from two congenital cases); Maydl, 4; and Keetley, 1. (No doubt other specimens exist, but, as far as I know, none have been examined with a view to determining the lesion accountable for the deformity.) Glancing at the pathological reports of these sixteen specimens, it is found that three presented evidences of rachitic changes; six presented a practically normal structure; two the changes of arthritis deformans; in two there were changes not unlike those of juvenile osteomalacia. Our accurate knowledge of the pathology is confined, then, to examples of rickets, osteomalacia, and arthritis deformans; there still remaining some specimens in which the lesions of none of the aforementioned diseases are demonstrable. The majority of the writers on this subject, not all, agree, in so far as they admit, that some softening process, whatever its nature, must precede the development of the deformity, and most of them believe that in all cases of coxa vara infantum the process is rickets. As for those cases occurring at the time of puberty opinions differ. Müller and Lauenstein speak of the cause as a rachitis adolescentium or the so-called "late rickets," which differs from the infantile form in that its manifestations are more or less localized and its course limited, claiming that in those specimens in which the structure was

found to be normal the rhachitic process had subsided, leaving no trace behind. Hofmeister is inclined to this view, calling attention to the influence of occupation upon the development of the deformity. Kocher, too, believes occupation to play an all-important part, but states that the presence of rickets in all cases is neither necessary nor possible. He sees in this connection an analogy between coxa vara adolescentium and genu varum adolescentium, as described by Mikulicz. Whitman distinctly states that rickets is not a *sine qua non*, but that the cause of the deformity is to be found among those of genu valgum, pes planus, etc. In the only adult case, which I have had the opportunity of examining personally, there was neither at the time of examination, nor, according to the history, previously any apparent sign of rickets. With a view to throwing some light on the question, I ascertained from the histories in what proportion of the forty tabulated cases there were evidences of rickets, with the following results: In twenty-three cases it was distinctly stated there were no signs of rickets, and in only five was the reverse the case, while in twelve no reference to rickets was made. It is safe to assume, however, that had rickets been present in those twelve cases, the histories would have contained some mention of it, so that we may reasonably state that but 12.5 per cent. of the entire group of cases belong to the rhachitic class. If we exclude from this calculation all those cases that might be strictly termed infantile, a group in the etiology of which rickets is generally recognized, we obtain these figures: of 26 cases there was only 1 in which rickets manifested itself, or 3.8 per cent.; of the 14 remaining cases 4 were congenital; leaving only 10 belonging to the infantile classes, and of these almost 50 per cent. did present evidence of rickets.

In substantiation of the views of Kocher and Whitman I find that in ten of the tabulated cases—*i.e.*, in 25 per cent.—there was associated with the deformity of the hip either genu valgum or pes planus, one or the other or both. In summing up the evidence as presented, the following conclusions may

be drawn. We recognize three classes of curvature of the neck of the femur: (1) Congenital; (2) infantile; (3) adolescent. (Fig. 4.) It is highly probable that in the majority of infantile cases the deformity is due to rickets, the presence of which is demonstrable in deformities of other parts of the bony anatomy; that in the so-called adolescent cases there is no demonstrable rhachitis, the real cause of the deformity being traced to some diminished resistance of the bone, the exact nature of which is still a matter of speculation.



FIG. 4.—Coxa vara congenita. (Kredel.)

*Predisposing Causes.*—In Hofmeister's table of 40 cases, in 32 the onset occurred between the ages of twelve and nineteen. The statistics of Hofmeister coupled with my own give 48 cases between the ages of twelve and nineteen; 18 cases between the ages of six and eleven; 10 under six years and 2 over nineteen years. It is reasonable to assume from the above that the period of adolescence is a predisposing cause. Occupation is believed by many, and rightly too, to be an important

TABLE III.

	Hofmeister.	Frazier.	Total.
Congenital . . . . .	0	4	4 } 10
Two to five years . . . . .	1	5	6 }
Six to seven years . . . . .	2	3	5 }
Seven to eight years . . . . .	1	1	2 }
Nine to ten years . . . . .	1	6	7 } 18
Ten to eleven years . . . . .	1	0	1 }
Twelve to thirteen years . . . . .	3	0	3 }
Thirteen to fourteen years . . . . .	4	0	4 }
Fourteen to fifteen years . . . . .	3	8	11 }
Fifteen to sixteen years . . . . .	14	5	19 } 48
Sixteen to seventeen years . . . . .	5	6	11 }
Seventeen to eighteen years . . . . .	3	0	3 }
Eighteen to nineteen years . . . . .	1	0	1 } 2
Twenty to twenty-one years . . . . .	1	0	1 }
			78

factor, and if we turn to those cases developing at this period, we find that in most instances the occupations required the patients to be constantly on their feet, and the character of the labor was that which would require considerable effort. Combining Hofmeister's with my own statistics the following were the occupations with the number of cases under each: Farm-hands 18; laborers 4; gardeners 2; dairymen 2; millers 2; brewers 2; news-boys 2. In addition there was one joiner, locksmith, weaver, saddler, baker, shop-girl, brick-maker, grocer's boy, wheelwright, gold-smith, furrier, domestic, and basket-maker. In but a minority is the character of the occupation such as would allow of the employee remaining in the sitting posture any length of time. Occupation thus would seem to be a predisposing cause. So too, probably, sex in so far as the male sex are engaged in the more severe occupations. Referring to the statistics, 70 per cent. occurred in males and 30 per cent. in females. The right and left limb seem to be affected with the same frequency, as the following figures show: Right leg 27, left leg 28; bilateral 19.

There remains yet to be considered one more factor,—namely, trauma. In not a few cases traumatism preceded the onset of the deformity; in some cases it seemed only trifling,

TABLE IV.

Sex.	Hofmeister.	Frazier.	Total.	Percentage.
Male . . . . .	31 77.2 per cent.	24 61.5 per cent.	55	69.6
Female . . . . .	9 22.0 per cent.	15 38.5 per cent.	24	30.5

but the resulting disability was so pronounced that the patient became disabled, and a fracture or dislocation of the upper extremity of the femur suspected. Trauma, occurring in a case where the deformity had already developed, often excited exacerbations and temporarily caused increased disability. To occupation and trauma Whitman adds another factor,—namely, predisposition to deformity. It seems to me not at all improbable that a disproportion between the weight of the patient and the size of the bones furnishes in some cases a clue to the situation. As Humphrey pointed out, the angle of the neck is constantly changing during the period of growth, and that this change is due chiefly, if not altogether, to the superimposed weight of the trunk. With this in mind, it is not unreasonable to assume that in a heavy patient, with slender bones, the existing disproportion between the body weight and the size of the bones may predispose towards the formation of an acute angle between the neck and shaft.

Kocher and Hofmeister explain the evolution of the deformity in different ways. Hofmeister holds the weight of the superimposed body accountable for the downward displacement of the head and neck. This may be mathematically explained by the law of the parallelogram of forces, one force acting in the direction of the neck tends to foreshorten it, another, acting at right angles to the first, tends to draw the neck downward. The nearer the neck approaches to a right angle, the greater will be the power of the second component force. (See Fig. 5, C.)

Practically, therefore, the deformity, when once started,

supplies itself with the physical elements sufficient for its further development. The bending downward of the neck is due, therefore, to the weight of the superimposed body, while backward displacement of the neck is caused by the traction of the muscular group attached to it.

Kocher agrees with Hofmeister only in part. He believes the body weight to be a factor in the displacement of the head, but the backward displacement and, in a measure, the downward displacement, he believes to be due to the traction of the Y-ligament. This is brought about by the loss of muscular tone, the muscular relaxation that is associated with this class of patients. The muscles relax and the trunk is

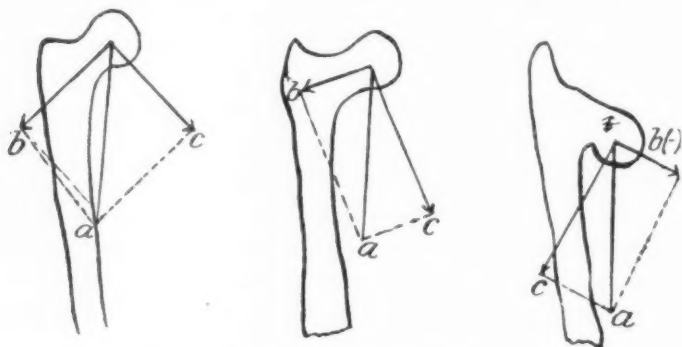


FIG. 5.—Diagram of Hofmeister.

suspended through the medium of the ligament which is thereby put on the stretch and drags the head downward and backward, simultaneously approximating the head to the posterior surface of the neck. This explanation differs from Hofmeister, who claims the backward displacement to be due to muscular traction on the great trochanter.

*Pathology.*—The number of specimens that have from time to time been removed at operations or on the post-mortem table are so few that our knowledge of the pathology is necessarily limited. A brief abstract will be given of reports of all specimens that have up to this time been removed, and from a general review of these we may be able to select the salient points that have hitherto been observed.

Richardson's specimen exhibited a deformity of the neck and head of the femur, which might have been mistaken for osseous union following fracture. The neck of the specimen was so depressed as to form with the shaft an angle of 45 degrees, much shortened and increased in its antero-posterior diameter.

Very little information can be obtained from the description of Monk's specimen. The trochanter is described as occupying a position higher and farther forward than normal, and the heads of the bones are considerably lower than the trochanters.

An examination of the wedge-shaped section of bone removed from the upper epiphyseal region of the femur by Keetley shows such changes as one finds in rickets. Keetley remarked that he himself had never seen a case of rickets in young adults, in which the upper extremity of the femur alone had been attacked.

Müller is, perhaps, the first to have given a detailed description of the gross appearances and altered structure of his specimen. The upper margin of the neck in his specimen is lengthened, and the distance from the tip of the great trochanter to the cartilaginous margin of the head is about  $3\frac{1}{2}$  centimetres less than normal. The upper border of the neck forms a slight convexity, while the lower border is concave. The distance from the lesser trochanter to the margin of the head is  $2\frac{1}{2}$  centimetres less than normal. The epiphyseal line appears as a thin streak; the line of separation between the diaphysis and epiphysis being easily recognized by the arrangement of the trabeculæ.

*The Structure of the Bone.*—There is thickening of the so-called Adam's arch, and the compact structure on the inner side of the neck has attained a thickness of  $1\frac{1}{2}$  centimetres; it changes suddenly to the spongy, unlike the normal condition in which the transition is gradual. There is a deviation from the normal in the arrangement of the trabeculæ. In the normal bone the most dense trabecular reticulum is between Adam's arch and the upper circumference of the articu-

lar surface of the head passing through the *under* and *inner* part of the neck. To the outer side of this the trabeculae are more loosely arranged. In the pathological specimen the arrangement of the trabeculae are quite different, here the trabeculae are most dense on the *upper* and *inner* portion of the neck, while in the under and inner part the trabeculae are less compact. There is no recognizable variation from normal in the consistence of the bone, nor on the surface of the bone or articular cartilage. The microscopical examination showed no specific changes.

Lauenstein's specimen was removed from a rhachitic subject six years of age. The neck formed a right angle with the shaft on both sides; the trochanteric epiphysis took a horizontal course, while the epiphysis of the head of the bone was directed upward and inward, or, in other words, in a vertical direction. The under border of the neck is very much shortened. On both sides the neck shows an abnormally great thickness, when compared with the thickness of the shaft or the relative thickness of the other bones. Especially characteristic of rickets are the thick lines of ossification, wider medullary spaces, and the presence of islands of cartilage scattered through the medullary tissue. On cross section both bones presented a thickened Adam's arch. The necks form an angle with the shaft of 36 degrees. Lauenstein believed that this specimen undoubtedly showed an underlying rhachitis.

Schultz furnishes us with a rather detailed description of his specimen, in which, however, he found no distinct rhachitic changes; the inferior surface of the neck is very much shortened, and is marked by a slight concavity, measuring only one-half centimetre. On the other hand, the superior surface of the neck is longer than normal, and is represented by a convexity. From the posterior aspect it is seen that the linea intertrochanterica, passing obliquely from above outward to below inward, approaches the posterior boundary of the head, so that a continuation of this intertrochanteric line (which ordinarily terminates in the trochanter minor) will ex-



actly intersect the lower half of the line forming the posterior boundary of the head. The neck is unusually broad, and is bent not only downward, but downward and backward. There is a change both in the shape of the head and in its relation to the neck; the normal femoral head represents two-thirds of a sphere, while a cross section of this specimen shows the head to be but one-third its normal size. Normally the spherical surface of the head is directed upward, but in this specimen it is more in the direction inward than upward, so that the view from behind overlooks a larger area of articular surface than can be seen from the anterior aspect. The epiphyseal lines are normal in every respect, with the exception that their direction instead of being horizontal is vertical. The position of the head and neck is that occupied normally by the limb in the position of abduction. Instead of only the articular surface of the head, there is in addition the greater part of the upper surface of the neck in contact with the acetabular rim. This portion of the neck resembles the cartilage-covered head and has moulded itself to the shape of the superior portion of the acetabulum.

*Changes in the Structure.*—Normally the density of the bone in the head and neck varies according to whether or not it occupies a position in the line of direct pressure. In that portion to which the weight is directly transmitted the osseous tissue is dense, while in the remaining portion the structure is more loose. Since the direction of the neck has changed and with it the direction of the line through which the weight is transmitted, that portion occupied by the densely arranged bony tissue occupies an area differing from that found in the normal bone. Apart from these changes in the bony structure, there are no demonstrable pathological lesions either on the surface or interior of the cartilage or bone.

Kocher has contributed to the literature of the pathology of this deformity a description of two preparations. Case I: On cross section the bone showed normal cancellous tissue; the neck of the femur is twisted downward and backward

around its transverse axis, and outward and backward around its vertical axis, thereby appearing from before backward thinner than normal. The neck is from three to four centimetres longer, and presents a marked convexity forward. The articular cartilage is present throughout, but in some places is attenuated, so much so that the cancellous tissue can be seen through it, and is even in some places exposed. Towards the neck the cartilage appears irregular, its irregular edges projecting beyond the head in the shape of an umbrella. The cancellous tissue beneath the cartilage is exceptionally loose, having large medullary spaces. Case II: On cross section the cancellous tissue appeared unchanged, except immediately beneath the areas in which the articular cartilage was attenuated, when the tissue was less compact. The epiphyseal line is in the upper portion plainly not broadened, but somewhat irregular. In the middle of the bone are several areas of cartilage separated from each other by cancellous tissue. There is no granulation tissue present. On cross section the trochanter appears normal, the cancellous tissue a bluish red. On the upper circumference, about three centimetres from the epiphyseal line, is the beginning of the more compact part of the neck. In the acetabulum and in the neck, at the attachment of the capsule, the capsule is somewhat injected and swollen.

Maydl described four cases, two of which presented lesions of arthritis deformans. Case I: The head was exceptionally flat and broadened. The surface and circumference of the head are studded with osteophytes, about the size of beans. The cartilage is present throughout, but attenuated. Case II: The head was not spherical but quite flat. There are no remains of the ligamentum teres. The articular surface is enlarged, measuring 8 centimetres horizontally and 5 centimetres vertically, and its border is covered with stalactitic osteophytes. The cartilaginous layer is thin; on cross section it is seen that at the epiphyses there is a remnant of bony tissue two to four millimetres thick. The areas of absorption project beneath the epiphyseal cartilage to a depth of three-

fourths millimetre into the medullary tissue, in which calcareous and osseous detritus are deposited without any definite arrangement. Case III: The head and neck are bent forward and downward, so that the superior and posterior surface of the neck glides over into the corresponding part of the head, while between the head and the neck there is a furrow three centimetres deep. The anterior and inferior portion of the head articulates no longer with the acetabulum, but is displaced forward beneath the anterior and inferior surface of the neck, and the inner surface of the femur just at the trochanter minor. The neck is flattened antero-posteriorly; on cross section it is scarcely one and a half centimetres thick. Vertically, however, the dimension is increased, measuring five centimetres. There is a double curve of the neck, somewhat concave forward in the inner half, and concave backward in the outer half. On the anterior superior portion of the line separating the neck from the shaft the osseous tissue is unusually compact. The structure of the tissue in the head and neck differs somewhat from the normal; the most dense cancellous tissue is found in the upper and outer portions; while in the remaining portion the trabeculae have a less compact arrangement. There is no trace of an epiphyseal line. Case IV: The appearance of the head and neck and the location of the furrow correspond with the description of Case III. Through extension of the articulating surface backward its horizontal dimension is increased to 10.5 centimetres, the vertical to 7 centimetres. The superior surface of the head is convex, while the posterior is flat, smooth, and does not project on the neck. The inner half of the superior surface of the neck is convex, the outer half straight, and its diameter throughout shows no variation. In the lower portion of the head and neck the tissue is dense and compact, whereas in the upper portion the structure is the reverse.

Kirmisson examined a specimen which he removed from an infant at the post-mortem table. The femoral head was much enlarged and could hardly be contained within the articular cavity. Between the head and trochanter major, on

the anterior surface, there is a bony prominence separated from the head by a groove. The trochanter minor projects considerably on the posterior surface. The ligamentum teres was hæmorrhagic and the posterior part of the capsule very much attenuated. The histological examination of the bone was entirely negative. The following is a description of specimens removed from another infantile case by Kirrison. The femoral heads are slightly flattened and the posterior superior portion is separated from the anterior inferior by a small ridge. There is no arthritis or increase of synovial fluid. On the anterior surface of the neck, as in the other case, there was a small eminence, which on transverse section proved to be a thickening of the capsule at its attachment. The cartilage is perfectly normal. The trochanter majora are displaced backward. A histological examination of the femora was absolutely negative.

*Résumé of Pathology.*—An analysis of the description of all the specimens subjected to examination furnishes us with the following data: The gross appearances of the deformity show a marked similarity. The neck of the bone is bent downward and backward, its superior surface elongated and convex, its inferior surface shortened and concave. In the majority of cases the neck was flattened so that its antero-posterior diameter was diminished and its vertical diameter increased. In some instances there was a marked furrow at the junction between the head and neck, supposedly due to the pressure exerted by the rim of the acetabulum. Examination by a cross section of the bone revealed a departure from normal in the structure of the cancellous tissue; in the upper half of the neck the cancellous tissue was much more compact than in the lower half, a condition the reverse of that found in the normal bone. This has been explained by the fact that, when the neck is bent downward, the line, through which the weight of the superimposed body is transmitted, and which normally passes through the lower half of the neck, now passes through its upper half. (See Figs. 6 and 7, a cross section of a normal and abnormal bone.) With these exceptions

there was no change noticed in cancellous tissue except in two cases, when it was described as being unusually spongy beneath the articular cartilage. The tissue situated at the junc-

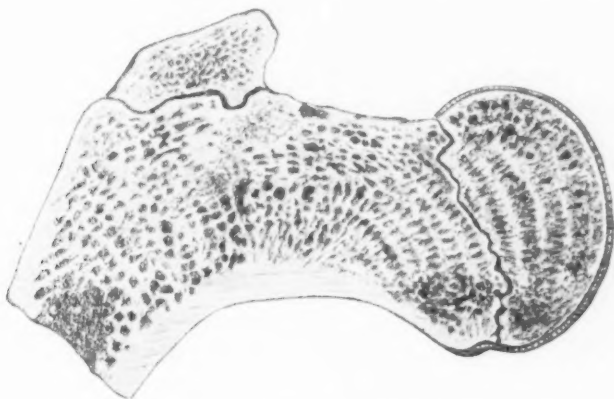


FIG. 6.—Normal bone, showing the structure more compact in lower portion of neck. (Schultz.)

tion of the neck with the shaft, or that portion known as Adam's arch, was in some instances more compact than nor-

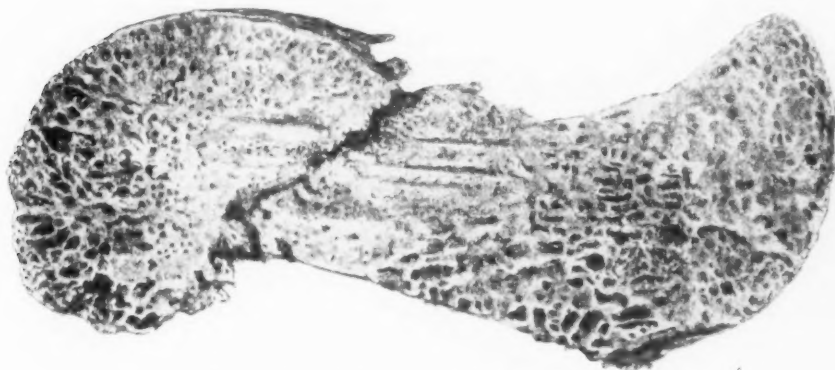


FIG. 7.—Head and neck from a case of coxa vara, showing more compact structure in upper portion of neck. (Schultz.)

mal. The epiphyseal lines, as a natural consequence of the deformity, had changed their direction, the trochanter epiphysis becoming horizontal and the epiphysis at the head ver-

tical. In one instance there was no trace of the epiphysis. There were practically no alterations in the articular structures,—that is to say, in the capsules, ligaments, and articular surfaces. In but two cases—namely, those of Keetley and Lauenstein—were there any changes characteristic of rickets, Lauenstein calling attention to the presence of small islets of cartilage, thickened lines of ossification, and abnormally large medullary spaces. It is a fact worthy of note that Kirmisson found no histological changes in either of his cases, both of which were congenital. In summing up the evidence, it must be concluded that whatever be the nature of the alteration in the structure of the bone that allows of its bending, the alteration is, in the majority of cases, not characteristic of rickets. Osteomalacia may be excluded, since it is a disease of adult life, and usually involves the entire skeleton, as in the single case described by Hofmeister. That there are numerous diseases of the bone that could cause the deformity,—*e.g.*, osteomyelitis, rickets, osteomalacia, chronic osteitis, arthritis deformans, etc.—is undoubted, but, up to the present time, the evidence does not admit of the acceptance of any one of these as the pathogenic factor in the majority of cases.

*Prognosis.*—With respect to the prognosis certain questions must be answered, Will the patient be permanently disabled? What degree of disability must be anticipated? etc. The first question is easily answered in the affirmative, because once the deformity has developed it can never be altogether rectified; there will always be a certain amount of shortening, which will at least make the patient walk lame. As regards the limited functional activity of the joint, this can be partially restored by operative intervention. It must be remembered that this, in most cases, is a self-limited disease; after the patient has reached the period of adult life there will be no increase in the deformity, and if we can rectify what deformity exists at this time, we can rightly expect that the results will be permanent. As regards the degree of permanent disability, this will altogether depend upon the amount of deformity present when the case comes under your observation. If it be slight, there is every reason to believe

the progress of the deformity will be checked, if appropriate treatment be carried out. If, on the other hand, the patient presents himself to you for the first time with a marked deformity, you can promise him improvement only through surgical intervention. Should treatment be neglected, the condition will usually go on from bad to worse, and, if the affection be bilateral, the patient may eventually be compelled to resort to crutches, since the resulting "scissor-legged deformity" makes locomotion difficult or impossible. In a small minority of cases, however, the patient seems able to carry on his or her daily occupation without increasing the deformity beyond a certain point. These remarks apply more especially to those cases of rhachitic and mechanical origin, but when osteomalacia or arthritis deformans are at the bottom of the trouble, the duration of the disease is unlimited, and the prognosis unfavorable.

*Diagnosis.*—It would not seem a very difficult task to make a differential diagnosis between this affection and other abnormal conditions about the hip-joint; nor is it difficult in the average case, if one is familiar with the course of its development and the history of the subjective and objective symptoms. As a matter of fact, however, in not a few of the cases that have been reported errors of diagnosis were made, some cases being mistaken for coxitis, some for congenital luxation, and others for impacted fracture of the neck, epiphyseal separation, and anterior subluxation. In many the diagnosis was not finally established until the exact nature of the deformity was disclosed at the operation. It is best to follow a systematic plan of investigation and examine the patient in regard to the following points:

- (1) Atrophy.
- (2) The position of the trochanter in relation to Nélaton's line.
- (3) The relative length of extremity, measured from anterior superior spine to internal or external malleolus.
- (4) Actual length of extremity, measured from the tip of trochanter to external or internal malleolus.
- (5) Extent of outward rotation.



- (6) Limitation of inward rotation.
- (7) Restriction of abduction or adduction.
- (8) Disturbances of flexion or extension.

When a case presents itself with the usual history,—namely, one of slow development, with perhaps occasional exacerbations following slight trauma, with the characteristic prominence of the trochanter and attitude of the limb, and presents marked interference with the functional activity of the joint, with comparatively little or no pain,—your suspicions should be at once aroused.

(1) *Diagnosis from Coxitis.*—A number of cases of curvature of the neck have been mistaken for incipient coxitis. In coxitis there is also a history of insidious development, but attended with the characteristic and sometimes most pronounced joint-pains. Motion is limited, but equally in every direction; never is motion in any one direction entirely free or abnormally so, as in the abnormally free range of motion in the direction of outward rotation present in coxa vara; while passive and active motion in coxitis elicit pain, in coxa vara they are painless. In the former there are signs of local inflammation, as evidenced by the pain on motion, pressure, etc. In coxa vara there is no local tenderness. One may be attended with elevations of temperature and eventually signs of suppuration, phenomena that are never observed in the other. The shortening in coxitis may be due to flexion of the limb on the pelvis or to absorption of the head and neck; in coxa vara it is due to the bending of the neck. Rest and extension will restore to the joint, in coxitis only, a perfect range of motion.

(2) *Diagnosis from Fracture or Epiphyseal Separation.*—It is well known that in coxa vara the subjective and objective disturbances may be very much aggravated by traumatism. It is in such instances that the necessity of a diagnosis from fractures or epiphyseal separations arises. The presence of crepitus, severe pain on motion, and localized tenderness are points that contrasted with the symptoms of coxa vara should be sufficient to differentiate the two affections.

(3) *Diagnosis from Congenital Dislocation.*—The only



symptom which these two affections have in common is the upward and backward displacement of the trochanter. If, however, in the case of congenital dislocation, traction be made upon the limb, the trochanter can be drawn down to its normal position. Some confusion may arise when the curvature of the neck is bilateral and causes the waddling gait, characteristic of congenital dislocation. In all cases, finally, the diagnosis may be confirmed by the skiagraph. (As far as I have been able to find out the accompanying skiagraph of my own case is the first one published in connection with this deformity.)

*Treatment.*—Of all the phases of this subject, the treatment has been given the least attention. One could sum up in a few words all the ideas of the management of the disease that can be gathered from literature. They include rest, extension, and massage, with attention to hygiene and the internal administration of phosphorus, if there are evidences of rickets.

When the case first comes under observation there is usually a certain amount of pain present, some muscular rigidity (such as we often find in a case of *pes planus*) which is partially accountable for the limited motion. Absolute rest in bed with extension meet these indications so well that in the course of a few days the pain and muscular rigidity will have disappeared; this will be an opportune time to determine the amount of limited motion due to the deformity itself. Extension has been applied by some, experimentally, of course, with a view towards reducing the deformity by traction, as it were, but, as had been anticipated, the results have been negative. When the pain and muscular rigidity have subsided there are no further indications for confining the patient to bed. If an apparatus can be constructed which will prevent the transmittance of any weight through the neck of the femur the patient should be allowed unlimited freedom. I have thought that an apparatus, such as the so-called Taylor traction splint, would answer this purpose well. It should be worn just as long as there is any danger of the deformity increasing,—that is, until the period of adolescence

is past. If, when the splint is discarded, there is some shortening, the patient should be advised to wear a sufficiently thick cork sole. Massage has been advised almost universally; when there is general relaxation and loss of tone of the muscles, an occasional predisposing cause of coxa vara, massage would seem to be indicated; so, too, should it be of benefit when, as is almost always the case, the affected limb has atrophied, and in this connection passive motion and certain exercises should be of service. The importance of the adoption of antirachitic *régime* in rachitic infants and children need only be alluded to. Operative interference is reserved for those cases in which the disability is pronounced, and this is especially true of the bilateral cases; a resection of the head and neck was the first operation performed for the relief of this deformity, at a time when its exact nature was not fully understood. This has been recognized as an unnecessarily severe operation, since there is no change in the formation of the head or articular cavity. More recently Kocher, Hofmeister, and others have advised a subtrochanteric osteotomy, and this was regarded as the proper operation until Kraske pointed out some objections to it. He claimed that if an osteotomy be performed, it should be through the neck of the bone, since a subtrochanteric osteotomy, while it may correct the malposition of the limb, cannot correct the limited functional activity and shortening, since the muscles that move the hip are attached above the point where the bone is divided and the upper section still remains in a faulty position. It has been offered as an objection to Kraske's operation that there is danger of subsequent ankylosis of the joint, if the latter is infected during operation. Kraske meets this objection with the reply that the attachment of the capsule in coxa vara makes it possible to perform his operation extra-articular. On account of lengthening the superior surface of the neck, the line in which the capsule is inserted is drawn inward towards the head, leaving a space between the capsule and trochanter major large enough to allow of the removal of a wedge-shaped section of bone. The following is a brief description of the operation: An incision beginning above and

to the inner side of the tip of the trochanter major and running downward to eight or ten centimetres exposes the linea trochanterica and base of the neck. The periosteum is divided for half the circumference of the neck and pushed upward a distance of two centimetres towards the head. A wedge-shaped section of bone is removed with its base two centimetres broad, directed upward and forward. Budinger has since modified Kraske's operation; he regards it unnecessary to remove a wedge-shaped section of bone, since simple division of the bone will answer the purpose just as well. He has reported a case in which he carried out this idea. After the operation a fixed dressing was applied, retaining the limb in a position of outward rotation and abduction (at an angle of 50 degrees). At the end of three weeks' time this dressing was removed and an extension applied, the limb being gradually returned from the abducted to the straight position. Passive motion was begun six weeks after the operation, the results of which were all that could be desired; the shortening disappeared and abduction and inward rotation were unrestricted. The success of the operation depends upon the position in which the limb is retained during the after-treatment. It should be placed in that position occupied by the head and neck,—namely, that of abduction and outward rotation,—so that when union has occurred the shaft will hold its proper relation to the head and neck.

BRIEF HISTORIES OF CASES THAT HAVE BEEN REPORTED SINCE HOFMEISTER'S ARTICLE IN 1894.

CASE I (Kocher).—The patient, a laborer, aged eighteen years, had never been sick till the past year, when he complained, for the first time, of darting pains in the left hip on walking. These pains were not very severe, still the patient began to limp. Following a period of rest or after fatigue the pains were more severe than after moderate exercise, and soon extended to the body and knees. The limping grew worse, but the patient did not take to bed. In two weeks the same train of symptoms appeared on the right side. Matters grew worse, and in August, 1882, the limping was very pronounced and the pain more serious. The patient went to bed for four or five weeks, but afterwards his condition was so much aggravated that he could only walk the length of the room. Since August he was only able to go about with the aid of two canes; the pain was not present if the patient kept quiet, but was

elicited by every movement or attempt at walking. The patient's condition on May 11, 1883, was as follows: He is a lean, slender, well-built young man. The legs are parallel; the right somewhat flexed and rotated outward. No inequality in length or tilting of the pelvis. Only with the greatest effort is the patient able to raise the legs extended while in the dorsal decubitus. Abduction and adduction are both limited; on the left side there is slight external rotation. In all attempts at passive motion on the right side the body moves with the thigh. There is no apparent abnormality in the conformation of the joint, and there is no pain on pressure. He can only flex the knees by moving the entire body, and one knee cannot be flexed without the other. The patient is able to walk only with some support, and makes great efforts with the body in order to raise the legs from the ground. The diagnosis of arthritis adhesiva was made.

Treatment consisted in an excision of the right hip-joint and breaking up of adhesions in the left under ether. The improvements in the motion of the right thigh were so marked that the patient requested an excision of the left hip-joint, and his request was granted.

CASE II (Kocher).—The patient, an eighteen-year-old boy, worked up to one year ago in the country and then went into a cheese manufactory, where he was required to stand the entire day, and was exposed to the cold. In February, 1893, he first experienced pain in the hip-joint, which was increased on motion and worse in bad weather. Three weeks afterwards he noticed that the right foot was turned outward, and within fourteen days the right foot assumed the present position. Abduction was complete, but flexion only possible to the angle of 40 degrees. To the end of May his condition remained unchanged. After a course of treatment in Baden he complained bitterly of pain on standing and felt weak. Pain in the right hip was greater than that of the left, and was felt especially after standing for a long period of time. The family history was negative, and the patient himself had never suffered from rheumatism.

His condition on the 31st of October, 1893, was as follows: The patient stood with his legs rotated outward, the left leg being in front of the right and in marked adduction. There was also a high grade of flat foot and a slight genu valgum. The right somewhat more pronounced than the left. The iliac spines were on the same level. The great trochanter was prominent on both sides, especially on the right, and both seemed displaced forward. There were no changes in the soft structures covering the joints and pressure on the bones and joints elicits no pain. The following measurements were taken: From the anterior superior spine to the external malleolus, left 96 centimetres; right 95 centimetres; from the anterior superior spine to the internal malleolus, left 94½ centimetres; right 94 centimetres; from tip of great trochanter to the articular line of knee, left 51½ centimetres; right 50 centimetres. The right leg is two centimetres shorter than the left. Flexion in the left hip-joint is possible only to 6 degrees; passive motion to 35 degrees; inward rotation is very much limited. The foot is markedly rotated outward. In the right hip-joint active flexion is possible to 15 degrees,

always associated with adduction, and passive flexion to 35 degrees; the right foot is also rotated outward. The thighs are not as strong as they should be, but neither are atrophic. The gait of the patient is very peculiar, and while at rest the patient stands with one knee in front of the other, as in genu valgum. The treatment consisted in resection of the hip on one side.

CASE III (Borchard).—A boy, aged fifteen years, was admitted to the hospital November 17, 1896, with the history of having been struck on the right hip by the pole of a wagon eleven weeks before. Immediately after the accident he could not stand erect and fell over backward on his right side. Several attempts were made at reduction, believing it to be a luxation, but naturally without success. On further questioning it was ascertained that he had experienced weakness in the left leg, especially after severe work and after long periods of standing during the past summer. In the dorsal position both spinous processes were on the same plane. The left trochanter being displaced both upward and backward, being two centimetres above the Roser-Nélaton line. The leg lay in a position of moderate adduction and slight outward rotation. Abduction is possible to 30 degrees, rotation inward is limited, outward rotation and adduction being normal. On flexion the left leg crosses the right and the foot is rotated outward. Pressure and passive motion are not painful, but active movements, standing and walking for any length of time, excite some pain. Diagnosis: "Coxa vara." Treatment: Extension, with the leg in the position of abduction for fourteen days. The patient was then allowed to go around with a high sole on the sound foot; massage was employed daily; extension applied at night. At the end of December the condition was much improved, and the patient able to go about without support and scarcely any limp. Examination on discharge: Position of trochanter unchanged. Inward rotation and abduction improved. On flexion the left leg no longer crosses over on the right.

CASE IV (Leusser).—The patient, aged eighteen years, complained for several months of moderate pain, aggravated by walking, and limped slightly. The occurrence of a slight accident—namely, stubbing her toe against a small stone—brought on severe pains in the joints. Family history was distinctly rhachitic. The patient herself had sustained previously a fracture of the right thigh, humerus, clavicle, and scapula. Examination: The affected limb was rotated outward; active motion excited the greatest pain, passive motion only moderate pain. Diagnosis: Impacted fracture of the neck of the femur. At the end of two weeks, and rest in bed, the error of diagnosis was discovered; further examination found the pelvis inclined towards the left, slight scoliosis in dorsal vertebrae, outward rotation of the left foot. Abduction is diminished; the other movements of the joint are normal. The left thigh is  $2\frac{1}{2}$  centimetres shorter than the right, and the trochanter is elevated three centimetres above the Roser-Nélaton line. Relative length of extremity on the left side  $88\frac{1}{2}$  centimetres, on the right side  $91\frac{1}{2}$  centimetres; absolute length on left side 85 centimetres; on the right 85 centimetres. Genu valgum especially marked on the left side.

CASE V (Schnitzler).—An eighteen-year-old girl, who has worked for the past four years in a shop where she was continually on her feet, experienced pain in the left hip and knee for the last four months. Soon she began to limp, and finally noticed some shortening. Lately the pain is present both on motion and at rest. Examination: Circumference, left thigh, 3 centimetres, and left calf 2 centimetres less than the right. Distance from spine and trochanter is  $2\frac{1}{2}$  centimetres shorter on left side. Flexion and extension are free; abduction abolished, and adduction very much diminished. Rotation inward is limited. Trochanter prominent.

CASE VI (Whitman).—Well-nourished boy, fifteen years old, appeared with limp on right side and shortening of leg, for which a high shoe was worn. Limping began about one year ago. Examination: Trochanter prominent, elevated upward and backward above Nélaton's line. Actual shortening  $\frac{3}{4}$  of an inch; apparent shortening  $3\frac{1}{2}$  inches. No limitation of flexion, extension, or rotation. Abduction was absolutely restricted. Two years later shortening increased to  $1\frac{1}{2}$  inches, trochanter became more prominent, pelvis tilted upward, and lateral curvature of the spine developed. In this case there was no evidence of rickets.

CASE VII (Whitman).—Well-nourished boy, aged sixteen years, has had flat-foot for indefinite period, and has worked for two years in a grocery-store, where he was required to lift heavy weights. The symptoms appeared the previous spring, a peculiar soreness and stiffness being felt in the right hip. These disappeared after a period of rest, but returned with increased severity when work was resumed. Soon the opposite hip became involved. Examination: Flat foot, slight knock-knee, and hyperextension at the knee were all present. Trochanters slightly elevated above Nélaton's line. Flexion and extension were complete, but abduction and inward rotation limited. The gait was rolling. After a treatment of rest and gymnastics he returned to work, but three months later reappeared, and at this time was able to walk with much effort, the body swaying from side to side. Trochanters markedly elevated and nearer the median line. Extension free but flexion and abduction limited. Examination four months later: Adduction so marked that on flexion one leg crossed the other. The trochanter is progressing upward and backward instead of forward. Lumbar lordosis well marked.

CASE VIII (Whitman).—An overgrown boy, aged seventeen years, has been employed for the past year as a baker, his occupation requiring him to stand for many hours each day. During the past year noticed bending of right knee and peculiar stiffness of left hip and thigh, most marked on changing from position of rest to one of activity. Examination: Well-marked knock-knee on the right side; trochanter slightly elevated, there being no actual shortening. Abduction and inward rotation restricted.

CASE IX (Whitman).—The patient, aged eleven years, news-boy by occupation, began to limp one year ago; complained of stiffness and discomfort in hip. Examination: Compensatory tilting of pelvis, ele-

vation of trochanter to an inch above Nélaton' line. Shortening one inch. Inward rotation and abduction are limited.

CASE X (Ogston).—Girl, aged fourteen and a half years, has been ailing for the past four years; she experiences difficulty and pain in both active and passive motion of the hip-joint. The arc of rotation outward and inward was less than the normal.

CASE XI (Ogston).—Patient, aged nineteen years, gives an indefinite history of pain in the hip for some years. Eversion is marked.

CASE XII (Ogston).—A boy, aged sixteen years, occupation brick-worker, has complained of pain in his hip for the past year. Moderate adduction and outward rotation. No measurable shortening of the neck of femur. On flexing the thigh the latter was rotated outward so that the foot passed across the sound leg, assuming a tailor's attitude.

CASE XIII (Kredel).—Coxa vara congenita. Little girl, aged three years, with marked genu valgum and muscular atrophy of both legs; is able to flex knee-joints only to a right angle. There is also clubbed feet on both sides. The femoral shafts are unaltered. On right side trochanter elevated  $3\frac{1}{2}$  centimetres; on left side  $4\frac{1}{2}$  centimetres. Flexion is normal, abduction and inward rotation are limited. Outward rotation is increased. When the child kneels both legs cross each other.

CASE XIV (Kredel).—A well-nourished, five-months old boy. Right leg  $1\frac{1}{2}$  centimetres shorter than left; outward rotation marked. On flexion the knee-joint to a right angle; the right leg crosses its fellow. Trochanter elevated 1 centimetre above the normal. Flexion normal, abduction and inward rotation absolutely restricted. There is marked pes equino varus. The left hip-joint is normal, but the knee-joint is quite stiff and the patella is absent. The same deformity of foot as on right side.

CASE XV (Zehnder).—Farmer, aged forty-two years, gives a history of rheumatism in infancy, following which he had an ankylosed elbow-joint. Up till his sixteenth year his gait was normal, but from that time pain began in the right hip, especially during the winter. One year later he began to limp. In the last seven years at times the pain has been severe, more especially in the last three winters. During the past year shortening has greatly increased. Examination: Trochanter raised 9 centimetres on right side; 6 centimetres on left above the Nélaton line. From trochanter to external malleolus, right  $89\frac{1}{2}$  centimetres, left  $91\frac{1}{2}$  centimetres. From anterior superior spine to external malleolus 82 centimetres on both sides. On the right side flexion is possible to 130 degrees. Right side abduction impossible. Adduction possible till leg crosses its mate in upper one-third of leg. Left side abduction only slightly possible. The left foot can be rotated outward to an angle of 50 degrees. On kneeling, the patient crosses one knee over the other.

CASE XVI (Zehnder).—The patient, a boy eleven years old, has had more and more difficulty since the time he first learned to walk. During the past year it was noticed that the right leg was always turned inward. Flexion on both sides is normal. Rotation outward is completely restricted; on right side abduction is impossible; on left side possible to a slight degree. Adduction possible on both sides. Length of limbs from



trochanter to the external malleolus is equal. Distance from anterior superior spine to external malleolus on right side, 1 centimetre shorter than on left. The right trochanter stands 5 centimetres, the left 4 centimetres, above Nélaton's line. Slight lordosis.

CASE XVII (Zehnder).—The patient, a letter-carrier, aged twelve years, has limped ever since he has been able to walk. Examination: The cartilages of the ribs are somewhat thicker than normal; although there are no other evidences of rhachitis. Distance from spine to external malleolus, right 59 centimetres; left 61 centimetres. Distance from right trochanter to external malleolus, on both sides,  $56\frac{1}{2}$  centimetres. Actual shortening 2 centimetres. The right trochanter is 2 centimetres higher than the left. Flexion and adduction are unrestricted. Inward rotation about the same on both sides, external rotation freer on left side than on right.

CASE XVIII (Zehnder).—A boy, four and a half years old, has since his second year complained of pain in the right hip. For the past year and a half the child has limped. Examination: No evidence of rhachitis beyond thickening of the costal cartilages. Right trochanter 2 centimetres above Nélaton's line. Distance from anterior superior spine to external malleolus, right 51 centimetres; left 53 centimetres. Distance from trochanter to external malleolus alike on both sides. Actual shortening 2 centimetres. Flexion is not diminished; abduction possible beyond the normal; rotation and adduction unrestricted.

CASE XIX (Zehnder).—The patient, a girl, aged nine years, has had a disturbance in her gait for the past six years. Slight thickening of costal cartilages gives evidence of rhachitis; family history negative. Examination: Distance from trochanter to external malleolus, left 64 centimetres; right 61 centimetres. Distance from anterior superior spine to external malleolus, 59 centimetres, on both sides. The right trochanter is 3 centimetres above Nélaton's line. Left trochanter exactly on Nélaton's line. Flexion and inward rotation undisturbed.

CASE XX (Zehnder).—The patient, a young girl, began to limp ten years ago. She was treated for coxitis and was bedridden for more than a year. For a while she walked with two crutches, but lately only uses one stick. No tubercular history. Examination: No evidence of rhachitis. Distance from spine to external malleolus, right 81 centimetres; left 75 centimetres. Distance from trochanter 79 centimetres, on both sides. Left trochanter 6 centimetres above Nélaton's line. Left leg is atrophied, adducted, and slightly rotated inward. Flexion is limited, as is outward rotation. Adduction is unrestricted and abduction possible to a slight degree.

CASE XXI (Frazier).—The patient, a girl, aged nineteen years, presented herself with the following history: The father and one sister died of consumption, two brothers died in infancy, one sister and her mother are living and well. Present history: About nine years ago she began to be troubled with vague pains in her bones, especially in the right hip-joint. Shortly afterwards she noticed a slight lameness affecting the right leg, the pain increasing when the lameness developed. At times she would have exacerbations of this pain, lasting sometimes as long as



a week; but at no time being severe enough to make her bedridden. The pain and lameness were especially severe after a hard day's work. Her occupation consisted in doing general work on the farm in Ireland, such work as would ordinarily be allotted to a man. Examination: Abduction of right leg possible to 35 degrees, left leg to 45 degrees; inward rotation very slightly restricted and painful in the right leg, and normal in the left. External rotation normal on both sides. The base of Bryant's triangle measured, on right side, 3 centimetres, on the left side 7 centimetres. Nélaton's line passes over the tip of the left trochanter. The right trochanter is  $4\frac{1}{2}$  centimetres above it, and is displaced upward and backward. The pelvis is tilted at an angle of about 5 degrees. The circumference of the right thigh  $49\frac{3}{4}$  centimetres; left thigh  $52\frac{3}{4}$  centimetres. Anterior superior spine to tip of internal malleolus, right,  $80\frac{1}{4}$  centimetres; left,  $80\frac{1}{4}$  centimetres. Umbilicus to tip of internal malleolus, right,  $84\frac{1}{2}$  centimetres; left,  $87\frac{3}{4}$  centimetres. Anterior superior spine to upper border of patella, right,  $40\frac{3}{4}$  centimetres; left,  $40\frac{3}{4}$  centimetres. Treatment: Rest in bed. Buck's extension to right leg. During the week the patient was in the hospital the temperature record was irregular, showing an evening rise varying from  $100.5^{\circ}$  to  $99^{\circ}$  F. At the end of two weeks' treatment the patient was again examined, with results corresponding exactly to those recorded on her admission, with one or two exceptions. Where abduction was only possible to 35 degrees, on admission, it was now possible to 55 degrees; flexion to 90 degrees; is free from pain. Further flexion elicits pain and arches the lumbar spine. It is also noticed that on flexion the affected limb crosses over its fellow. The trochanter is displaced upward, but not backward, as was recorded in the first examination.

CASE XXII (Bauer).—In November, 1894, a seventeen-year-old servant-boy was admitted with the following history: There was no tubercular taint in the family. When five or six years of age he had experienced pain in the left leg, followed by shortening and limping. After a while these symptoms disappeared. When fifteen years of age, while employed in digging ditches, the pains in the left leg returned, and he again began to limp. Though the pain was never severe, he soon had to give up his occupation. Genu valgum developed on the left side. Examination: The left leg is shortened, adducted, and rotated outward; the pelvis somewhat oblique, but no lordosis; the left trochanter somewhat elevated; muscles somewhat atrophied. Forced movements were painful. The patient was treated for three weeks with rest in bed, extension, and massage; after which, being considerably better, he was discharged, wearing a high sole on the injured side.

CASE XXIII (Bauer).—The patient, aged seventeen years, was a milk-carrier, beginning to work at the age of eleven, and when thirteen was forced to carry large milk-cans. About eight months ago he fell and hurt his knee, the injury was followed by some trouble in the left hip, which was aided by warm baths. Mother died of heart- and lung-disease, nine brothers and sisters of some acute disease. Examination: No abnormality in head, spine, or upper extremities. Internal organs perfectly healthy; the head of the left trochanter was  $3\frac{1}{2}$  centimetres;

that of the right 2 centimetres above Nélaton's line. The leg was rotated outward and the movements at the hip-joint were restricted. Treatment: Rest in bed, extension, and massage. Result: Improvement.

CASE XXIV (Bauer).—In February, 1895, the patient, aged sixteen years, a farm laborer, presented himself with the history that for the last two years he had pain on exertion on the right side of thorax. In the summer of 1894, after a fall, the patient began to limp. Later on in the year, while working at ditching, the pains returned with greater severity than in the summer. Examination: No signs of rhachitis. Right trochanter  $2\frac{3}{4}$  centimetres above Nélaton's line, left barely up to it. The leg is rotated outward, rotation is limited, and the muscles of the right thigh measure 4 centimetres less than the left. Under chloroform narcosis the movements were found to be almost normal; abduction was somewhat limited and to a less degree inward rotation. Treatment: Rest in bed, extension, massage, and bath. Patient was discharged, wearing a high sole on the injured side, very much improved.

CASE XXV (Ciuti).—Several years previous to 1897 the author met with a case which he at first confounded with incipient coxitis. The patient was treated by a resectio subtrochanterica. The operation was followed by complete cure.

CASE XXVI (Renssen).—In January, 1894, the patient, aged fifteen years, complained of pain in his right leg and hip. There was slight limp. Inclination of pelvis to the right, slight scoliosis; both trochanters on the same horizontal plane, but the right more prominent. The articular movements were normal; no pain on pressure over the hip-joint. Treatment: Rest in bed for two weeks, oleum hyoscyami being applied locally. The pain disappeared but the limping remained. The patient was discharged with instructions not to undertake hard and difficult labor.

CASE XXVII (Budinger).—In November, 1895, the patient, a girl, aged fifteen years, complained for some time of limping and sharp pain in the left hip. The patient herself was poorly developed, and from a distinctly rhachitic neighborhood. In April, 1896, her condition was much worse, the pain was more severe, the leg shorter, and the movements more limited. For the past few weeks she has been bedridden, and relies entirely upon crutches to get about. Examination: There was marked genu valgum and flat foot on both sides, exaggerated on the left. The patient herself was poorly nourished. Internal organs normal. Both femora are very much rotated outward, the left being 3 centimetres shorter than the right. The tip of right trochanter is 1 centimetre, the left 4 centimetres, above Nélaton's line. Abduction and outward rotation are limited on the right side, while on the left they are exaggerated. Inward rotation is very much restricted, while flexion is entirely free. The treatment consisted in an excision of a wedge-shaped section of bone from the neck of the femur. This operation can be carried out without opening the capsule. The result was satisfactory, the articular movements of the joint were restored.

CASE XXVIII (Fabricant).—The patient, a girl, eight years of age,

presented herself for treatment September 16, 1895, complaining of pain in the left groin and limping. Her family history was negative. The pain first appeared in February of this year, originating in the hip and extending to the knee. Soon afterwards she began to limp. Examination: The patient is of rather tall stature for a girl of her years, with rather poor muscular development. The pelvis is tilted, the left side being lower than the right. Compensatory scoliosis. The left leg is shorter than the right, rotated outward, with some muscular atrophy. Left trochanter  $2\frac{1}{2}$  centimetres above the Roser-Nélaton line. Active and passive motions of the hip-joint were painless but limited. Abduction was especially restricted. Treatment: Rest in bed with extension followed by massage. The course of treatment lasted two and a half months, at the end of which time the patient could walk without limping or without discomfort.

CASE XXIX (Fabricant).—The patient, a girl, aged seven years, was first seen November 2, 1895. Previous history: She was the last of eleven children; developed slowly; was not able to walk till the third year, after which time she began to limp. The limping soon became worse, and some pain was experienced if the child was on her feet for any length of time. No distinct rhachitic history. Examination: Development commensurate with her age. Prominence of right trochanter, which was  $3\frac{1}{2}$  centimetres above the Roser-Nélaton line. Compensatory scoliosis. Flexion limited to 90 degrees and outward rotation. Treatment: Rest, extension, and massage. Result unknown.

CASE XXX (Fabricant).—The patient, a girl, aged eight years, was first seen September 20, 1895. She had suffered from the usual diseases of childhood and had experienced pains in the epiphyses of the long bones. No distinct rhachitic history. For the past two years her parents noticed that her gait was unnatural. Examination: The right leg flexed and rotated outward. Trochanter prominent and 2 centimetres above the Roser-Nélaton line. The pelvis tilted, but no scoliosis. Active and passive motions were painless. Treatment: Rest, extension, and massage. At the end of six months' time the extremities were of equal length and the patient walked without limping. The trochanter was on a level with the Roser-Nélaton line.

CASE XXXI (Fabricant).—The patient, a girl, aged seven years, was first seen November 2, 1895. Her father was scrofulous and her mother had suffered from scoliosis. The patient herself, an ill-developed child, was subject to attacks of diarrhoea and diaphoresis; a year and a half ago had a suppurating lymphadenitis of the cervical glands. She began to limp about seven months ago and complains now of pain in her right hip. Examination: Right leg shorter than left and rotated outward. Trochanter prominent and  $1\frac{1}{2}$  centimetres above Roser-Nélaton line. Active and passive motions painless and unrestricted. Treatment: Rest, extension, and massage. In the course of a month the pain had disappeared and the patient walked without fatigue and limped but little. Five months later the extremities were of equal length and the limping had disappeared.

CASE XXXII (Ghillini).—Patient, a girl, aged sixteen years, gave

no distinct rhachitic history. Her mother noticed that she limped when a small girl, but that she was free from pain. When ten years of age the pain first appeared, and was so severe at times as to impede walking. A diagnosis of coxitis was made and twenty-five injections of an iodine preparation were employed without success. Re-examination: The left leg was shorter by 2 centimetres than the right. The great trochanter was 2 centimetres above the Roser-Nélaton line. Abduction, flexion, and internal rotation were limited. Treatment: Massage and gymnastics. The pains disappeared, but owing to the unequal length of the limbs the limping continued.

CASE XXXIII (Ghillini).—The patient, a boy, aged fourteen years, was born of healthy parents. At the age of two years he developed rickets and genua vara. When six years of age he first complained of pain and limping on walking. Examination: Right leg 3 centimetres shorter than left; right trochanter 2 centimetres above the Roser-Nélaton line; left thigh somewhat atrophied. Extension and abduction are limited. The limb is rotated outward.

CASE XXXIV (Schneider).—The patient, a boy, aged eighteen years, was perfectly well up to two years ago. His father and mother are living and well; his three sisters have died of causes unknown to him. The pains in the hip began about two years ago, persisting when the patient was at work, acquiescing after a good night's rest. He was employed since his fourteenth year as a field hand. During the past year, walking became more and more difficult, the pains became more aggravated, and the patient began to limp and experience difficulty in stooping. Examination: The patient is fairly well nourished and of moderate muscular development; no evidences of rickets. Genu valgum present on both sides; the feet are rotated outward. Flexion is possible only to a right angle and somewhat painful; abduction is limited to 17 centimetres; inward and outward rotation are also somewhat restricted. Both trochanters are higher than the Roser-Nélaton line. In walking, the patient swings the body to and fro and crosses one leg over the other. A radiograph was taken, but the result was unsatisfactory. Treatment: Rest, extension, and nutritious diet were followed by amelioration of the subjective symptoms. Any attempt, however, to walk for any length of time brings on fatigue.

CASE XXXV (Kirmisson).—A boy, aged nine years, admitted to the hospital May 8, 1896, presented numerous rhachitic deformities, among which were a pronounced dorso-lumbar scoliosis, curvatures of the tibial and femoral shafts. The foot was directed to the front. The great trochanter on the right side was  $2\frac{1}{2}$  centimetres higher than on the left (above Nélaton's line). The trochanter was not only displaced upward but forward. The radiograph revealed a similar picture on both sides,—namely, curvature of the femoral diaphysis near the neck, perhaps more pronounced on the left side. The case was looked upon as a rhachitic curvature of the femoral neck, probably of congenital origin.

CASE XXXVI (Kirmisson).—Male, aged two and a half months, was admitted to the hospital November 28, 1896. Nothing is known of the child's antecedents. It was small, cachectic, and quite emaciated.

Examination: Both limbs were rotated outward, flexion was incomplete. Two swellings, symmetrically located, were present in the groin between the head of the femur and the great trochanter, offering obstacles to the natural motion of the limb. Result: The child died December 13, 1896. At the autopsy it was found that the femora were in forced external rotation, and that the great trochanters were displaced upward and backward.

CASE XXXVII (Kirmisson).—Patient was admitted to the hospital when sixteen days old. The child was extremely emaciated, but presented no traces of syphilis. Examination: The lower extremities were habitually flexed. There was double club-foot. Both femora were rotated outward. The trochanters on both sides were on a level with Nélaton's line, 2 centimetres behind the superior anterior iliac spine.

CASE XXXVIII (Maydl).—The patient, fifteen years of age, came of apparently healthy parents. Up to one year ago she was perfectly well. At this time she slipped in going down-stairs, striking forcibly her right hip. Fourteen days after the accident she complained of pain localized in the hip and knee, coming on after walking. Examination: The right leg is in the position of moderate abduction, flexion, and outward rotation. Active motions are possible only when accompanied with movements of the pelvis. The right trochanter was displaced 4 centimetres above Nélaton's line. At present she limps, but has no pain. Treatment: Resection of the hip-joint. The patient was discharged cured several months afterwards.

CASE XXXIX (Maydl).—A laborer, aged eighteen years, was admitted to the hospital July 12, 1895. There was no rachitic family history. The patient himself had always enjoyed perfect health until the onset of the present disease, which was caused by the patient stumbling over a piece of coal, two days after which he felt pain in the affected limb. Subsequently the limb became emaciated and the motions became more restricted. Examination: The patient was of large stature, with a strong bone frame-work, good muscular development, and remarkably well nourished. The left leg is rotated outward, and both active and passive motion in the joint absolutely restricted. The length of the extremities is equal. Treatment: Hip-joint resection. The head was found to be both widened and flattened.

CASE XL (Maydl).—A laborer, aged eighteen years, was admitted to the hospital February 25, 1896, with a good family history. During the summer of 1895, after jumping over a hedge, he experienced pain from his hip to his knee on the left side. Since that time he has limped and has been unable to bend the leg. Examination: The patient is developed proportionately to his age. The left leg is rotated outward, slightly abducted, and shortened. The motions of the left hip-joint are entirely restricted. Trochanter prominent. Treatment: Hip-joint resection. It was found at the operation that the neck was so bent that the head touched the small trochanter.

CASE XLI (Maydl).—The patient, a seventeen-year-old boy, was admitted November 23, 1896, with the following family history: The

mother was an epileptic, of nine brothers and sisters five died early, the remaining four are living and well. In October, 1895, the patient first experienced pain on walking, beginning in the buttock and extending to the popliteal space. The pains almost vanished in April, and did not return until October, 1896. Examination: Rather tall in stature, with good bony frame-work, and well nourished. The left leg is moderately rotated outward, slightly flexed, but with no noticeable shortening. With the pelvis fixed active and passive motion is limited. The trochanter on the left side is prominent. Treatment: Hip-joint resection. The head and neck presented the deformity of coxa vara.

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THE QUESTION OF OPERATIVE INTERFERENCE  
IN RECENT, SIMPLE FRACTURES OF  
THE PATELLA.<sup>1</sup>

BY CHARLES A. POWERS, M.D.,

OF DENVER,

PROFESSOR OF SURGERY IN THE UNIVERSITY OF DENVER; SURGEON TO ST. LUKE'S  
HOSPITAL AND TO THE ARAPAHOE COUNTY HOSPITAL.

It is now twelve years since Dennis made his well-known report on this subject, at the close of which, in recommending open arthrotomy and osseous suture, he said,—

“It will be for the future practice of surgery to pass a final verdict upon this method of treatment of fracture of the patella, after a study of the results obtained in the few years to come. . . . With the gigantic strides which modern surgery is making, it is safe to predict that in careful hands this operation will be devoid of every risk to life.”

And recently this distinguished author, while continuing to adhere to operative interference, repeats (Dennis's “System of Surgery,” Vol. i, p. 558), “While the number of cases yet operated upon is too limited to admit of deductions by means of which a final settlement of this question can be made in the minds of surgeons, the future practice of the surgery of this and of other countries will soon enable us to condemn it as an unsafe and unjustifiable procedure, or else it will be conceded as one of the grandest triumphs of our art.”

It cannot be denied that the statistics of Dennis made but a poor argument in favor of open arthrotomy in recent, simple, transverse fractures. Bull (*New York Medical Record*,

<sup>1</sup> Read at a meeting of the American Surgical Association, New Orleans, April 19, 1898.

<sup>2</sup> Dennis's System of Surgery, Vol. i, p. 558.



March 22, 1890), in a consistent article opposing operative measures, said,—

“Of wiring the patella, it is needless to say that, while it made its entrance into practice by the advocacy of the pioneer in antiseptic surgery, Sir Joseph Lister, it has never received general support. . . . It is sufficient to know that death and disaster from amputation and suppuration and ankylosis have followed its performance in the hands of the many, and that we have no evidence that when, in the hands of the few it has proven safe, the ultimate results have been better than those by non-operative methods.” The statistics of Brunner and Beck, which appeared at about the time of Dennis’s article, also argued against arthrotomy and in favor of simple measures. But the past decade has brought advance in all departments of operative surgery. The field has steadily widened, and the improvements in aseptic technique have led to increased faith in the safety of operative procedure. Operative interference in simple fractures of the patella has increased in frequency rather than diminished. It numbers among its adherents many of the most distinguished of our craft, and it is the object of this inquiry to determine, so far as may be possible, what its true place is and wherein lie its limitations.

In addition to the operative risks which attend any major procedure certain anatomical conditions render the knee-joint an especially important field in the event of septic mischief. It is a synovial membrane wide in area, difficult of thorough cleansing, with many nooks and recesses. Infection once under way may spread with great rapidity. Czerny, in a recent personal communication, says,—

“I do not know why the danger in operations for fractured patella is greater than in many cases of laparotomy, but I feel that it is so.” It may be that a rational explanation for this lies in the vastly greater lymphatic drainage which the peritoneum presents. In the highly advanced stage of our aseptic art the risk of infection in open arthrotomy of the knee may be a small factor at this day, but it is a constant



one. The surgeon may be morally certain that his wound will pursue an aseptic course, but he cannot be absolutely sure of this, and, as said, this danger, while slight, will yet be constant. In the consideration of the subject, then, two prominent conditions command our attention; the danger to life and limb and the value of the procedure as evidenced by improved ultimate results. For unless it can be shown that the latter out-weigh the former operation must fall to the ground.

The first of these conditions can at this time be estimated with a fair approach to accuracy. Enough cases are on record to enable us to judge well regarding the danger. But in the matter of ultimate results our conclusions must be in large part inferential, as with but few exceptions the cases have been reported too soon after operation. They are instances of operative recovery, and they permit an expression of the individual opinions of the reporters, but they unfortunately do not warrant judgment as to the definite usefulness of the limb after the lapse of a suitable length of time. We need late reports on large series of cases from individual operators. The cases should be thoroughly tested after a lapse of one or two years, for in no class of fractures does time make greater changes. A patient presenting a good result and a highly promising condition at the end of two months may walk badly, a year later, through stretching of the callus, while gradual muscular improvement may render the converse true. Tests should be made systematically and should be both structural and functional (Myles).

(a) *Structural Tests*.—The patella may be examined as to union of the fragments by illumination by the Röntgen rays, by palpation by the fingers when the leg is extended and flexed and when the weight of the body is borne on that limb. Mobility of the patella as a whole is to be inquired into.

The joint is tested for arthritis by passive motion, and the state of the muscles may be a guide to this. Stiffness short of ankylosis and tending to wear off is indicative of a low grade of joint inflammation.

Atrophy of the muscles may be tested by mensuration, by palpation, and by ability to contract under the fingers in response to electrical currents.

(b) *Functional Tests.*—Voluntary flexion and extension, ability to ascend and descend stairs, to dance and kneel, to raise the heel while lying on the back, to raise the heel from a high-stool while standing erect on the opposite limb, to spring from the floor and to hop while standing on the affected leg only. Ability to walk ordinary distances without early and unusual fatigue, and to pursue occupation when the latter be difficult.

Enough of these tests should be made to permit of judgment regarding the result after one or two years; but very few of the reported cases bear this examination.

The truest test as to result is the ability to walk long distances, to pursue arduous occupations, to easily ascend and descend stairs, and the like. This, in most instances, depends on preservation or restoration of the quadriceps femoris and absence of arthritis quite as much as on the condition of the patella itself. The union between the patella fragments may be very close and the functional use of the joint poor, while numerous instances are recorded in which the fragments are separated by several inches yet in which the limb is strong and useful. Rupture or preservation of the tendinous expansion of the vasti is of great importance in determining the result in these cases of marked diastasis.

While the union between the patellar fragments is generally spoken of as bony or ligamentous, there are so many recorded instances (Sayre, Stimson, Bogdanik) in which post-mortem examination has proved an apparently bony union to be fibrous that it would seem best to discard the term "bony union" and substitute "complete" and "incomplete." The former to denote failure to obtain independent mobility of the fragments, while an incomplete union may mean a short or a long fibrous callus. True bony callus cannot stretch. While it may occur, it is of such rarity that it need hardly engage our attention. Indeed, Pibræ (Coriton,

"Thèse de Paris," 1892) offered one hundred louis for positive proof of it. It matters not, however, whether the callus be bony or fibrous so long as the fragments be intimately joined and remained so.

*Mechanism.*—The majority are due to muscular action, the patient endeavoring to save himself from falling, the quadriceps femoris being strongly contracted at the time. While Brunner found but 17 per cent. of tear-fractures in the cases from Bruns's clinic, and while Bähr (*Sammlung klinische Vorträge*, 1894, No. 107) had observed eight cases of direct trauma in a total of twice the number, yet the weight of clinical evidence is much in favor of the preponderance of cases of muscular origin. Aside from the history given by the patient, often untrustworthy, the examination directly after the accident may aid in determining the nature of the injury. Wide separation of the fragments with prolapse of the prepatellar tissues into the breach speaks for a muscular origin. Contusion fractures have less diastasis and less intervening tissue as well as less lateral laceration of the soft parts, hence in these the prognosis is the better. Muscular action rarely causes fracture unless the knee is bent at the time. Here, as Macewen (*ANNALS OF SURGERY*, Vol. v, p. 181) has shown, the sudden development of the full retractive force of the powerful quadriceps causes the patella to be jerked upward, relatively to the femur, beyond the position where it usually lies supported laterally by the femoral patellar surface. The patella being held below by the powerful ligamentum patellæ rests on the apex of its posterior vertical ridge, which thus becomes the point upon which is developed the greatest contractible power of the quadriceps extensor on the one side and the weight of the body on the other. The patella is thus converted into a lever of the first order, and the strength of this lever not being sufficient to stand the strain, it gives way and the transverse fracture of the patella is the result. Somewhat similar is the mechanism of the contusion fracture when the knee is bent. I think Bähr correct when he says that the blow usually falls on the under half of the patella when the

upper half is lying against the lower end of the femur. Thus the patella is broken off and not through.

With the vertical fractures, as well as with those which are complicated, or with rupture of the tendon of the quadriceps or of the patellar ligament we have nothing to do in this article.

*Pathology.*—In the fractures due to muscular action there are but two fragments. Of these the upper is generally the larger. The fractured surfaces are, as a rule, irregular, the line of fracture may be transverse or oblique. In the latter event it is apt to run from above and without downward and inward. At times but a shell of bone may be torn from the lower angle of the patella, leaving the bone itself practically intact. In the contusion fractures the lesion may be single or comminuted; not infrequently the latter, the so-called star-shaped fractures. These contusion fractures may be associated with fracture of one or other of the epicondyles of the femur, but this is of rare occurrence. The fractured surfaces are generally fairly even. Chapius and Stoops each found a V-shape in the upper fragment, the lower being correspondingly grooved.

The fragments may lie in a normal plane or they may be turned or twisted. Crickx ("Le Massage et la Suture osseuse dans les Fractures de la Rotule," Bruxelles, 1896) thinks that ordinarily the fractured surfaces are turned towards the skin, and that this is due to the insertion of the rectus and the patellar tendon on the anterior surface of the bone. Howard Marsh found this condition in two out of ten of his recently operated cases, the fractured surface of each fragment looking anteriorly. Roswell Park found the fractured surface to be turned posteriorly in one of his operations.

Of the greatest importance in these fractures are the associated lesions in the capsules of the joint, the lateral tendinous expansions of the vasti, the so-called "ailerons" of the French writers. These tears are often met. Indeed, Crickx says that they are almost invariably present when the diastasis amounts to two centimetres. The femoral

aponeurosis is generally left intact. The prepatellar bursa is torn and the synovial pouch is opened to a greater or less extent. The more extensive the lateral tears in the aponeurosis the greater will be the synovial lesion, and the more complete is this synovial laceration the greater will be the accompanying hæmarthrosis, for more bleeding takes place from the very vascular synovial membrane than from the fractured surfaces themselves.

Riedel, of Jena, lost from chloroform a patient on whom he was operating for recent patella fracture. On continuing his examination he found a tear two centimetres long in the upper part of the synovial pouch beneath the triceps and much extravasated blood beneath the muscles of the thigh. He attributed this tear to energetic contraction of the subcruræus muscle, the tensor of the synovial pouch. Klemm, of Riga, has made a similar observation. Fowler, of Brooklyn, calls attention to this lesion as explaining the extension of suppuration from the knee-joint to the deep parts of the thigh, and other authors claim that blood thus extravasated may by pressure and organization lead to or add to atrophy of the thigh muscles.

Hæmorrhage into the joint is always marked; it is more extensive in the muscular fractures and in those in which the fragments are widely separated, for, as said, in these cases the synovial membrane is more seriously lacerated. The organization of the clots leads to adhesions and arthritis.

The prepatellar tissues fall into the breach. This is a matter of the greatest importance. First described by Macewen, later studied in detail by Hoffa, and since confirmed by almost all observers who have operated, there is now no room for doubt that the prolapse of the floor of the bursa and the aponeurotic fibres at the front of the patella is of constant occurrence in all cases of fracture due to muscular action, while Phelps and other writers state that it is almost invariably found in breaks due to direct violence.

*Conditions tending to cause Imperfect Union: Obstacles to Union.*—In seeking these we can most properly judge regard-

ing measures which are calculated to attain the best possible results, for that ordinary results after fractured patella are far from perfect is admitted by all. These conditions may be enumerated as follows:

(1) Separation of fragments: due to (a) retraction of the upper fragment from contraction of the quadriceps femoris and a slight drawing down of the lower fragment through shortening of the ligamentum patellæ; (b) effused blood.

(2) Tilting of the fragments (this may be present to a marked degree and unrecognizable without operation).

(3) Rupture of the tendinous expansion of the vasti and of the lateral portions of the capsule of the joint.

(4) Prolapse of prepatellar tissues into the breach.

(5) Atrophy of the quadriceps femoris: due to (a) disuse; (b) arthritis; (c) marked contusion of the muscle; (d) blood extravasated from the joint through the rent in the upper part of the capsule.

(6) Arthritis of the knee-joint, this possibly resulting in

(7) Adhesions of the patella. Further, though of but little value, may be added

(8) Natural poverty of the blood-supply to the bone (rendered negative by the fact that vertical fractures heal satisfactorily), and

(9) Exceptional tendency to osteitis, seen in fat people, in the aged, and in certain conditions of the blood.

These factors may, perhaps, best receive consideration as we discuss the management of the fracture.

*Non-Operative Management.*—No better evidence of the unsatisfactory results attending treatment of fractured patella by mechanical means need be adduced than the great variety of plans and devices which have been set forth from time to time. Berger ("Dictionnaire encyclopédique de Médecine;" Coriton, *Gazette des Hôpitaux*, 1892, lxxv, p. 1349) has reckoned up no fewer than ninety-one different methods, and in the literature of more recent date I easily find enough to make the number over one hundred. It will suffice at this

place to call attention to but three or four of these. First and best known, the general plan of making the closest possible approximation of the fragments, after subsidence of the joint swelling, by properly applied bandages or strips of sticking-plaster, and then confining the limb on a splint or in a plaster-of-Paris dressing. Of the various posterior splints Agnew's is perhaps as suitable as any. In approximating the fragments care is taken to see that they tilt as little as possible.

Millar, of Edinburgh, thought that the interposed aponeurotic tissues could be removed by friction, but this is improbable. Bony crepitus may indicate contact at one point only. Early aspiration of the joint effusion may succeed if done before the blood clots, but this clotting takes place early, and after it occurs the joint can only be emptied by a broad trocar and canula. This, with or without irrigation, may well be thought almost as serious a procedure as open operation.

The use of Malgaigne's hooks, or of the modifications by Levis or Otis or Duplay, as an aid to coaptation seems to have declined. Treves speaks well of them, and they are still used to a moderate extent in France. I have seen but little of the method, but do not judge that they give results superior to simple dressings.

The most valuable of the non-operative forms of management I take to be that of massage, the so-called "Dutch" method. Introduced by Tilanus, of Amsterdam, in 1885, this measure has had extensive trial, and all who have employed it speak well of it. A brief description is as follows: During the first twenty-four or forty-eight hours the limb is elevated and the joint compressed by an elastic bandage. On the second or third day the massage is commenced, and should be carried out by the medical attendant himself. The upper fragment is fixed by the fingers of one hand, while with the other gentle massage is made from the knee along the thigh muscles. If an assistant steadies the fragments both of the surgeon's hands can be used in this. Effleurage or stroking of the knee is made; the muscles are to be kneaded. The



leg should also receive attention. At first the *séances* should be from eight to fifteen minutes in length, but the time may be increased as the days go by. The massage should be made twice daily; it will provoke pain in the early days, but this rapidly subsides. The degree of pain will perhaps govern the amount of the massage at first, but after a few trials the patient will experience a sense of comfort and relief. Between the massage *séances* the fragments are held in apposition by straps of plaster, and the limb is so elevated that the extensors of the thigh are relaxed and the return circulation favored. Passive motion is begun very early; it prevents adhesions, both intra-articular and between the torn or bulging synovial membranes and the capsule of the joint, as well as between the soft parts and the condyles of the femur. This passive motion should be progressive, but should not be carried to the point of causing marked pain. Further, the patient should be up and about on crutches early,—by the eighth or tenth day. Two weeks later he discards the crutches and walks with two canes, later still with but one cane. In the average case the joint effusion will have disappeared by the end of the third week, and at this time the patient will be able to flex the leg to 135 degrees. By the fortieth day he will walk quite well. He is to wear a suitable check apparatus (one of the best of which has recently been described by Howard Marsh in the *British Medical Journal*) until flexion is beyond a right angle.

So far as the immediate results go it is not difficult to see that the Dutch method is superior to other non-operative procedures, and while, as I have said, observers have generally reported their cases at too early a day, I am inclined to think that the remote results surpass those attained by the older methods.

Ham ("De Voor en Nadeelen van de Behandlung," etc., Amsterdam, 1893) reports twenty-one cases, a majority of which had been observed for one year. While it is difficult to get at the exact results, it is evident that nearly all had complete and strong extension, and flexion almost equal to



that on the opposite side. In five out of the twenty-one cases there was complete union of the fragments, a percentage which is certainly above that attained by confinement methods.

Zum Busch (*Centralblatt für Chirurgie*, 1895, p. 449) reports on eleven cases treated by the method of Tilanus. He let his patients get up and go about in a simple splint with a cane on the second day; all returned to work at the end of six weeks, at which time each could lift the leg from a high-stool while standing on the opposite foot. The author does not give the amount of separation of the fragments nor the degree of flexion of the leg, but it must be admitted that the work test is a satisfactory one and the results exceedingly good. I find reports of numerous individual cases which confirm the value of the massage treatment (faradism to the muscles may be an adjuvant in this), and can make no doubt that it is the most satisfactory and valuable of the non-operative methods of management. Aside from this I can find no statistics as good as those of Bull, who reports (*New York Medical Record*, March 22, 1890) on sixteen cases of recent fracture treated by plaster-of-Paris splint with appropriate confinement of the fragments, and observed by him at periods varying from one year and nine months to thirteen years after the date of the injury. Of these sixteen cases the ultimate result was excellent in fourteen, or  $87\frac{1}{2}$  per cent., and bad in two cases, or  $12\frac{1}{2}$  per cent., of the whole. A review of Bull's cases seems to show but four in which the cause was clearly muscular action. The patients, for the most part, pursued arduous occupations after the injury. One was a metropolitan policeman, two were firemen, two truck-drivers, two laborers, two housekeepers, one a waiter. This form of treatment involves confinement for about six weeks, at the end of which time the patient can resume any amusement or occupation that can be carried on with a knee stiffened with a ham-splint. During the following three months much care must be exercised to prevent accidents. Without citing further references, it may, perhaps, suffice for me to repeat

that while the massage treatment entails arduous work on the part of the surgeon a careful study of the subject convinces me that it yields the best results of any of the non-operative forms of management. Crickx, in an extended argument in favor of open suture, compares this only with massage, which latter method he takes as the type of the simpler forms of treatment.

*Operative Treatment.*—So far as I am able to learn, the first operations for the cure of fractured patella were made by Rhea Barton and by McClellan, of Philadelphia. These were followed by Cooper, of San Francisco, in 1861, and afterwards by Logan, Gunn, Cabot, Kuhne, Abridge, and Heine. The results varied, but were on the whole far from encouraging, septic processes being rife in all open wounds of this preantiseptic day. It was, therefore, reserved for Lister to deliberately place the operation on a plane commanding attention and respect. This renowned surgeon, with faith in his theory and practice of antisepsis, sutured a fractured olecranon in 1873, and at this time proposed to do the same with broken patellæ, but it was not until 1877 that he carried out this resolve, at this time submitting a freshly broken knee-cap to open arthrotomy and suture, the result being a marked success. In 1883 he presented seven cured cases to the London Clinical Society and argued in favor of the procedure. The operation was essayed by other surgeons, but the risk attending it was acknowledged to be great, and it found but little favor. From time to time cases were exhibited and the question was warmly argued for and against. Many modifications of the open arthrotomy of Lister were devised with a view to avoiding the dangers of sepsis, some of these sought to bring the fragments in contact without opening the joint.

In this country early, consistent, and progressive work was done at Bellevue Hospital in New York, and to Dennis, Stimson, Phelps, Fluhrer, and the other surgeons of that institution is due, in large measure, the advance in favor which the operation has made.

In estimating the place which it occupies in surgery to-day I have felt it of very great advantage to gain the personal opinions of a certain number of surgeons. With this in view letters of inquiry were addressed to the active and honorary fellows of this association, to the members of the New York Surgical Society, and of the Philadelphia Academy of Surgery, these being purely surgical bodies.<sup>1</sup>

The queries embraced the general question as to advisability of operating on recent, simple fractures, the form of operation preferred, the number of cases operated, with results, and the time at which, in average cases, patients could resume daily life either with or without operation. To these letters of inquiry ninety answers were received, and I beg at this time to express my gratitude to those who so kindly replied. The consensus of opinion therein expressed certainly represents fairly the judgment of the surgeons of our country.<sup>2</sup>

The following say that they have had insufficient experience in the matter and thus refrain from expressing an opinion: D. P. Allen, E. H. Bradford, J. H. Brinton, P. S. Conner, N. P. Dandridge, J. McF. Gaston, C. L. Gibson, Reginald Harrison, W. W. Keen, Willy Meyer, G. H. Monks, E. M. Moore, J. H. Packard, J. Paget, and P. Syms, while L. B. Bangs, G. E. Shoemaker, H. A. Wilson, and V. P. Gibney have worked for some years in other directions than that of general surgery, and so decline to render judgment.

The remainder, seventy-one in number, make the following statements:

ROBERT ABBE would operate only when there is wide separation of the fragments with probable future displacement. In operating prefers vertical incision, removal of interposed structures, circular patellar suture of heavy silk. Insists on operative

<sup>1</sup>To these have been added the names of Drs. Phelps and Fluhrer, of New York, because of their well-known experience in the matter.

<sup>2</sup>While the answers are not reproduced in full, no important statements are omitted.

removal of interposed fibrous structure. Has operated three times with excellent results. Thinks that general practitioners and most surgeons should refrain from operating. Patients resume daily life in about three months with or without operation.

O. H. ALLIS would operate in cases in which there is comminution with hæmorrhage into the joint, also in single fractures with wide separation of the fragments. Would do open arthrotomy. Would not operate in simple cases without much separation of fragments. Patients return to work in non-operated cases in about two months.

JOHN ASHHURST, JR., does not consider the operation justifiable.

J. M. BARTON operates in cases due to muscular contraction. Open arthrotomy and silver wire. Two successful cases. "Would operate whenever aseptic conditions are within reach." Operated cases resume daily life a little the earlier.

R. B. BONTECOU has operated on three cases,—two satisfactorily, one (comminuted) died from sepsis. In general prefers Malgaigne's hooks.

C. K. BRIDDON would operate only in cases in which the distention of the joint interferes with a reasonable approximation of the surfaces. Prefers vertical incision with free exposure, suture by heavy, chromicized catgut or silver wire. Has operated on two cases with satisfactory results. If massage is used patients resume daily life in from six to eight weeks, there being but little difference between non-operated cases and those submitted to operation.

F. TILDEN BROWN does not approve of operative interference.

J. D. BRYANT has operated on nineteen cases; one died of delirium tremens a few days after the operation. "The others had limbs which, at the time of the escape from observation, were in all ways progressing to a favorable and complete termination, which bespoke a useful joint." Does not believe in operation as a general measure.

H. L. BURRELL would operate in cases in which the fragments cannot be approximated or in those in which the patella has been the seat of multiple fractures. Prefers open arthrotomy by longitudinal incision with two or three buried wire sutures. Has operated on three cases with satisfactory results. Patients

resume daily life in six months to a year in non-operated cases, and in six months in those submitted to operation.

A. T. CABOT refers to *Boston Medical and Surgical Journal*, November 19, 1891, in which he says: "It is the writer's feeling that in simple fractures of the patella the added risks of an opening into the joint are so great that the best treatment is by apparatus."

W. H. CARMALT employs subcutaneous suture with silk-worm gut in cases in which the fragments are not easily brought into close apposition. He has operated on four cases with satisfactory results. Non-operated cases return to work in three months, and operated cases in six weeks.

N. B. CARSON has operated in one case with resulting partial ankylosis. Would operate on selected cases.

D. W. CHEEVER does not believe it wise to resort to operative interference in any case of recent, simple fracture of the patella, and thinks the results of non-operative treatment in ordinary cases sufficiently good to warrant a continuance of this form of management. The non-operated cases resume daily life in about three months, patients wearing a guard splint.

JOHN CHIENE does not operate. Gets excellent results from sticking-plaster suitably applied.

H. W. CUSHING has never resorted to operation, but would do so in case the patient requested it after the facts had been fully explained to him. Prefers vertical incision, irrigation of joint, accurate suture of fragments, and their coverings by silk or silver wire. In non-operated cases patients resume daily life in about eight weeks with support, and in from eight months to one year without support.

V. CZERNY does not believe it wise to operate in recent, simple fractures, because the risk of inflammation and ankylosis is too great. Does not know why the danger of inflammation in operations for fracture of patella is greater than in many cases of laparotomy, but feels that it is so. Form of operation, open suture by silver wire. Has operated on one or two cases with resulting inflammation and ankylosis. Believes that with a separation of two to four centimetres the use of the limb is generally sufficiently good. Non-operated cases return to work in from two to six months.

C. W. DULLES: "I do not think, taking advantages and

risks together, that operation is wise. I think that one death or ruined joint in a hundred would determine this,—and we have absolutely no statistics that we can trust to show how many operations have ended disastrously." Non-operated cases resume daily life in about three months.

G. G. DAVIS would operate in all cases in which the fragments cannot be brought almost or quite in contact by simple pressure. Has operated with satisfactory results in about six cases. Non-operated cases resume daily life at the end of two months, but wear protective apparatus for a year. Operative management shortens the treatment, the wire allows use of bone by preventing refracture. Passive motion is safe as soon as the wound is soundly healed, say, at the end of three or four weeks. The joint limbers up sooner and the patient can resume work safely without apparatus.

J. B. DEEVER employs posterior splint (Agnew) with adhesive straps where fragments easily fall together. In case they do not well appose he uses Malgaigne's hooks.

F. S. DENNIS operates when the patient is perfectly healthy, when separation of fragments is wide, when time is of great importance, when both patellæ are fractured; uses silver-wire suture. Has operated on thirty cases; satisfactory results in twenty-nine. Believes the cases for wiring should be very carefully selected; the viscera should be healthy and absolute asepsis is imperative.

W. F. FLUHRER would operate in all cases in which no contra-indication exists. Uses silk or catgut suture, but would be prepared to employ silver wire if necessary. Drills fragments and approximates, after thoroughly washing out the joint. Does not consider results in non-operative cases sufficiently good. Has operated on thirty cases with satisfactory results.

G. R. FOWLER would operate when fracture is due to indirect violence with a decided separation of the fragments. The operation should be intermediate, after subsidence of the primary coincident effects of the injury on the soft parts and before ligamentous union has taken place, or as a secondary operation; never as a primary operation. Employs open arthrotomy with suture of capsule when fragments can easily be apposed; otherwise suture fragments with aseptic kangaroo tendon. Has operated on thirty-eight cases; satisfactory results in thirty, suppura-

tion in seven, death in one. It should be said of the seven suppurative cases that six occurred in patients in whom the operation was performed as a primary procedure. There were thirteen of these primary operations, therefore suppuration occurred in nearly 50 per cent. Of the twenty-five intermediate or secondary operations, infection occurred in but one, and in this was traced to the catgut. Non-operated cases resume work in six weeks, those submitted to operation in eight and one-half weeks.

B. B. GALLAUDET operates in all cases in which there is a separation of the fragments to the extent of one-quarter of an inch or more. Employs curved incision and wiring. Has operated in seven cases; satisfactory results in six, suppuration in one. Patients return to work in three or four weeks in non-operated cases, and in about eight weeks in those submitted to operation.

G. W. GAY would operate in young or middle-aged patients who are in good health and obliged to earn a living. Prefers open arthrotomy and wire suture. Has operated on several cases with satisfactory results. Both non-operated cases and those submitted to operation resume daily life at the end of three or four months. "I give you my conclusions based upon a moderate experience and a larger observation. It is not proved to my satisfaction that the operative cases are ultimately any better off than are those not subjected to operation. There are good and bad results from both methods of treatment. It is a safe operation, and the immediate result is first class in the large majority of cases, even if there be some suppuration, though I have never had infection. I have seen the fragments pulled apart at the end of four months, and the fracture do well under a second wiring."

A. G. GERSTER believes operation is rarely needed. He has employed simple suture with stout catgut in three (satisfactory) cases. Non-operated cases resume daily life in six weeks, those subjected to operation in two months.

C. GUSSENBAUER has treated twenty-five to thirty cases of patella fracture. Four times has made suture; in the other cases uses what he calls "dry, not bloody, suture" with good results. Has always considered the open operation indicated only in comminuted fractures with much separation of the fragments.

W. S. HALSTED operates on all of his own cases. Perfect result in fifteen. No suppuration; no drainage. In the hands



of competent surgeons operation yields the best results. Only those sure of asepsis should operate.

R. H. HARTE prefers Malgaigne's hooks when any form of operative interference is necessary. Would use them when the fragments cannot be well approximated without.

F. HARTLEY operates in cases in which the fragments cannot be well apposed by straps. Open arthrotomy, catgut suture of fragments and aponeurosis of vasti. He has operated on twenty-seven cases. Twenty-three were satisfactory, in the other four cases the adhesions were so marked as to render the results unsatisfactory. Under either form of management patients resume daily life in from six to eight weeks.

J. HOMANS uses silk suture to fascia and periosteum. Satisfactory result in two cases. In the average case non-operative treatment is sufficiently satisfactory. Both operated and non-operated cases resume work in about three months.

W. BARTON HOPKINS obtains such good results from a special (ANNALS OF SURGERY, 1895, p. 682) appliance that he is less and less inclined to operate. Might operate in young, healthy subjects with wide (one and a half inches) diastasis. Non-operated cases resume work in about three months.

VICTOR HORSLEY would wire in every case unless there are especial contraindications. Has operated in a number of cases. Suppuration in one, acute, gouty bursitis patellæ in one, wire caused irritation, and had to be removed in one case. Does not treat any cases without operation. Patients return to work in about six weeks.

O. HORWITZ would operate in cases in which the fragments cannot be apposed. Prefers Barker's operation with subcutaneous suture, but in comminution would do open arthrotomy, uniting fragments with silver wire. He has operated in eight cases with satisfactory results. In five by Barker's method, and in three by open arthrotomy. In one case a silver wire suture ulcerated through the skin five months after operation. Patients resume daily life in from eight to ten weeks in non-operated cases, and in about the same length of time in those submitted to operation.

RALPH H. ISHAM does not operate in any case. Non-operated patients resume daily life in about three months.

T. KOCHER operates in all cases in which the fracture is



transverse, with diastasis by laceration of the capsule on both sides of the patella. He has operated on twenty-four cases; satisfactory results in twenty-two, suppuration and stiffness in one, death in one. Employs longitudinal incision with direct suture of the fragments or of the soft parts. Operated cases resume daily life much sooner than those not subjected to operation. "I think it quite essential that the distinction should be made between cases with and without diastasis,—that is, with largely torn soft parts and with more or less intact fascia and capsule. Where there is no diastasis, the best plan is massage with or without puncture of the joint. Where there is great diastasis, I think actually we should always perform the operation, as the time is over when there was a risk of infection and its consequences. My cases of suppuration, stiffness, and death are of the first I operated upon long ago."

L. C. LANE would operate in all cases in which the fragments are extensively separated. Prefers open arthrotomy by transverse incision, removal of clots, trimming off of ligamentous shreds, suture of fragments by kangaroo tendon. Has operated in three cases with satisfactory results. In one of these there was slight extra-articular suppuration under one portion of the flap. In all of his cases treated by non-operated methods many months were required to reach moderate restoration of function, while in those submitted to operation the use of the joint was regained much earlier.

R. G. LE CONTE would resort to open arthrotomy and wiring when the joint is greatly distended with blood and the fragments cannot be brought together. Non-operated cases resume daily life in from ten to twelve weeks.

H. LILIENTHAL prefers the Dutch method of massage. "An office or quiet in-door occupation can be followed during treatment. Functional results perfect, even to hopping on the injured leg. Cure in six weeks. Treatment requires daily supervision and work by surgeon himself." Has operated on one case; satisfactory result.

LORD LISTER: "I may say that operative interference in recent, transverse fracture of the patella was in my hands uniformly satisfactory in its results, and that in my opinion it should always be resorted to, provided always that the surgeon can

reckon with confidence on the wound following an aseptic course."

A. J. McCOSH would operate in (*a*) cases in which it is impossible to approximate the fragments within one-third inch of each other; (*b*) in cases of repeated fracture of the same patella; (*c*) in those in which bony union is especially desirable on account of the occupation of the patient. He unites the fragments with suture of chromicized catgut or silver wire, and has operated in two cases with satisfactory results.

T. A. McGRAW has never operated on cases of recent, simple fracture, and thinks the cases requiring operation very rare. In such cases would prefer silver-wire suture. Non-operated cases resume daily life in about three months.

C. H. MASTIN has had very good results follow ordinary management, and has not met a case which, in his opinion, required operative procedure.

S. MARKS does not recommend operative interference in any case of recent, simple fracture of the patella. In non-operated cases patients resume daily life in from eight to twelve weeks.

J. EWING MEARS: "Regarding the patella as a sesamoid bone, I regard its fracture as incidental to a rupture of the important ligament in the folds of which it is embraced, and therefore believe that the ligament should be the important structure to be treated, and attempts to secure union between the fragments of the bone to be regarded as of secondary importance. Having observed that the disability in a large number of cases of non-union and of separation to a greater or less extent of the fragments was not very great, I have even advocated in some instances the removal of the fragments and the suturing of the divided ends of the ligament. I dwell particularly upon the marked difference in the symptoms and conditions following fracture of the patella when it occurs, on the one hand, as the result of muscular contraction and, on the other hand, as the result of violence or force applied directly. In the first instance there is rupture, tearing, and stretching of the fibres of the ligament, thus producing the separation of the fragments of the bone, which at the same time yields to the force which separated the structure of the ligament. In the second, where the force is applied directly, the bone encased in the ligament may be fractured, the fibres of the ligament contused but not ruptured or stretched,

and as a result of these conditions there is no separation of the fragments. I think we may correctly conclude from these facts that the ligament is the essential factor or agent, and that the bone plays a secondary part. Hence I believe that the expression 'fracture of the patella' may be abandoned or removed from surgical nomenclature. Hence, also, I believe that treatment should be applied to very strong and firm suturing of the ligament, as well as the wiring of the bone if it is allowed to remain *in situ*.

"In treating fractures of the patella, so called, by the older methods, I have insisted upon rest in bed and with plaster and splint applications for a period of three months, and have also insisted on non-use of the limb for a period of three months after getting up from bed. By this treatment I have gotten very firm union of the lacerated fibres or bone, I care not which. I have found that this treatment gave good permanent results." Number of cases operated not given, all said to be satisfactory.

J. E. MOORE operates in healthy subjects who desire it after the entire matter has been explained. Employs open arthrotomy with wiring. He has operated in five cases with satisfactory results. Operated cases resume daily life in six weeks, non-operated in three months.

T. G. MORTON would operate whenever it is impossible to bring the fragments in close apposition. Uses heavy catgut suture. Has operated on a number of cases without trouble; thinks there is no danger in the procedure. Patients resume work in about three months with or without operation.

F. W. MURRAY is content with simple forms of management and decidedly opposed to operative procedures.

C. B. NANCREDE would operate only in cases in which the opposite patella had been fractured, the patient young, and the operation managed by an expert in asepsis. Non-operated cases resume daily life in about three months.

J. E. OWENS has operated on all cases during the past five years. He has operated on six cases,—suppuration in one, death in one. Both of these latter cases had multiple injuries. "I have operated of late because of the trouble experienced in consequence of portions of the capsule dipping down between the fragments and preventing union."

J. H. PACKARD has had no experience with operative meas-

ures; has always obtained excellent ultimate results from the use of ordinary non-operative methods or from Malgaigne's hooks. Does not condemn operative management if thoroughly aseptic.

ROSWELL PARK would use wire suture and would operate in healthy subjects, providing the surroundings were satisfactory. Does not consider non-operative management satisfactory. He has operated on ten cases with good result in each. Operated cases resume daily life in eight weeks, non-operated cases in from fourteen to sixteen weeks.

C. PHELPS would operate in all cases in which there is no general contraindication. He has operated on 104 cases with satisfactory result in ninety-eight, superficial suppuration with more or less false ankylosis in six. Says he has had bony union in all cases. Washes joint out thoroughly, and considers operation absolutely safe with proper aseptic precautions.

L. S. PILCHER would operate in all transverse fractures when the patient can be treated in a hospital with well organized aseptic operating facilities. Prefers longitudinal incision with trimming away of fibrous fringes and approximation of fragments by chronic gut suture to aponeurosis of capsule. He has operated with satisfactory result in fifteen cases. Does not think the results of non-operative treatment sufficiently satisfactory when requisite experience and facilities for aseptic operative work can be secured. In non-operated cases patients resume daily life in about twelve weeks, in those submitted to operation in from four to six weeks.

C. B. PORTER is convinced that wiring shortens the period of convalescence by two-thirds. He has operated on seven cases; very satisfactory result in each. Operation should be done only by a skilled surgeon.

T. G. PORTER operates in no instance. Non-operated cases resume work in from four to six weeks.

T. F. PREWITT has never met with a case of recent, simple fracture in which he thought it advisable to operate. Removes splint in three months, and enjoins caution in use of limb until the end of six months.

J. RANSOHOFF would not operate in the vast majority of cases. Extensive hæmorrhage into joint might justify operation.

M. H. RICHARDSON has not operated in recent cases. Thinks the result in the average case to be sufficiently satisfactory without operation. Patients resume daily life in six months in non-operated cases, and does not think that operated cases should return to work much earlier. Intends to operate on future cases in which the separation of fragments is wide.

J. B. ROBERTS would operate on all cases in which the separation of fragments is not easily overcome by pressure straps of adhesive plaster. Prefers Levis's modification of Malgaigne's hooks. He has never resorted to open arthrotomy in recent, simple fractures. Thinks patients return to work in from six to eight weeks with the knee-joint extended in non-operative cases, and probably a little earlier in those in which the hooks are used.

L. A. STIMSON would operate in practically all cases in which skilled assistance can be had. The exceptions are recent fractures by direct violence (comminuted and without separation of fragments), and in some cases in which the separation is but slight. Prefers longitudinal incision with mediate suture through tendon of quadriceps and ligamentum patellæ crossing in front of bone, or suture of fibroperiosteum at seat of fracture. He has operated on seventy cases with satisfactory result in each. Does not advise operative interference except with the aid of trained assistants and under most rigid aseptic conditions. In the operations done by him nothing but instruments touch the wound, thereby the risk of inflammation is less. In cases submitted to operation patients get about in plaster splint after ten days, wear it for about a month, and return to hard work on the feet at the end of two or three months. Now uses catgut as periosteal suture. "As to ultimate results, I have seen but few patients after the third month; at that time all could, with one exception, flex to a right angle. Some, at a much later date, had full flexion. A few have come back with refracture from forced flexion while the joint was still stiff."

N. SENN does not advise operation in recent, uncomplicated cases.

L. M. TIFFANY operates when the fragments are widely separated and when there is much distention from joint extravasation. Selects healthy subjects of suitable age. Uses longitudinal incision, with suture of fibrous capsule and wiring of

bone if necessary. Has operated in four instances with satisfactory results. Would not operate in ordinary cases. Thinks patients can return to work rather earlier when subjected to operation.

W. W. VAN ARSDALE "would operate in healthy, strong individuals under forty years. Operation, open incision, Fluhner's drill, two silver wires not penetrating the joint." One case, satisfactory result. Patients able to resume work in eight weeks with operation, three months with massage, and one year with splints only. Believes refracture to take place quite as readily after operation as in cases treated by massage or splints.

A. VANDER VEER believes non-operative methods sufficiently satisfactory in average cases. Has had no experience with operative methods. Patients resume daily life in seven or eight weeks under either form of management.

J. C. WARREN does not think the results of non-operative management sufficiently good in average cases. Applies animal suture to periosteum and fascia. Has operated in three cases with satisfactory results. Non-operated cases resume daily life in about six months, those submitted to operation in about three months. Has used wire suture with satisfactory result, but, as said, prefers animal suture of periosteum and fascia.

F. S. WATSON would operate in cases in which there is but little or no comminution, in those in which neither the upper nor the lower fragment is so small as to make it impossible for sutures to hold, and in cases in which there is evidence of considerable effusion of blood into the joint. Has operated in two cases with satisfactory result in each. In non-operated cases patients resume daily life in from three to four months, while in those submitted to operation six weeks to two and one-half months suffices.

S. H. WEEKS would not operate in any case of recent, simple fracture. In non-operated cases patients resume daily life in about three months.

R. F. WEIR does not think it proper to operate in any case.

H. R. WHARTON operates only in exceptional cases, uses heavy silver wire. In average case non-operative management is satisfactory. Patients resume work in eight weeks without operation, a little sooner with operation.

J. W. WHITE operates in all cases in which there is separa-

tion of the fragments. Employs Barker's operation, and has had satisfactory results in fifteen cases. Operated cases return to work in three to four weeks, non-operated cases in from eight to twelve weeks.

G. WOOLSEY operates in cases with wide separation of fragments and those in which massage and elastic compression do not satisfactorily reduce the effusion and allow the approximation of the fragments in a reasonable length of time. Applies absorbable suture to fibrous tissues at edges of fragments. Has operated on four cases with satisfactory results. In average cases massage and passive motion from the start give excellent results. Non-operated cases treated by massage and passive motion return to work in five or six weeks, and cases submitted to operation do not regain functions as rapidly. His non-operated cases get either bony union or such a close fibrous union that it is impossible to distinguish.

J. A. WYETH is not an advocate of open arthrotomy in any case of recent, simple fracture, but might consider the propriety of it in certain rare instances, where the individual must of necessity have restoration of function within two or three months after the accident. In ordinary cases non-operative management requires about eighteen months of careful guarding of the knee from over-flexion, before there is complete and safe restoration of function. After two or three weeks' confinement to bed patients are allowed to go about with a protective splint.

NOTE.—Since the preparation of this paper I have received a reply from Dr. J. D. Rushmore, of Brooklyn, in which he expresses a preference for Malgaigne's hooks; from Dr. R. Matas, of New Orleans, who operates in selected cases; from Professor Max Schede, of Bonn, who does not resort to open operation; and from Dr. F. Kammerer, of New York, who would operate in exceptional instances.

*Summary.*—The following would use Malgaigne's hooks in suitable cases where the fragments cannot easily be approximated: R. B. Bontecou, J. B. Deaver, R. H. Harte, and J. B. Roberts.—(4.)

The following express themselves as opposed to operation in any case: J. Ashhurst, Jr., F. T. Brown, A. T. Cabot, D. W. Cheever, J. Chiene, V. Czerny, C. W. Dulles, R. H.



Isham, H. Lilienthal, C. H. Mastin, S. Marks, F. W. Murray, T. G. Porter, T. F. Prewitt, N. Senn, S. H. Weeks, and R. F. Weir.—(17.)

The following would operate in all cases in which no distinct contraindication exists and in which the surroundings are satisfactory: W. F. Fluhrer, W. S. Halsted, Victor Horsley, T. Kocher, Lord Lister, J. E. Owens (practically), Roswell Park, C. Phelps, and L. S. Pilcher.—(9.)

The following would operate on selected cases, those with wide diastasis, comminution, etc.: Robert Abbe, O. H. Allis, J. M. Barton, C. K. Briddon, J. D. Bryant, H. L. Burrell, W. H. Carmalt, N. B. Carson, H. W. Cushing, G. G. Davis, F. S. Dennis, G. R. Fowler, B. B. Gallaudet, G. W. Gay, A. G. Gerster (rarely), C. Gussenbauer (rarely), F. Hartley, J. Homans, W. Barton Hopkins (rarely), O. Horwitz (Barker's operation), L. C. Lane, R. G. Le Conte, A. J. McCosh, T. A. McGraw (rarely), J. Ewing Mears, J. E. Moore, T. G. Morton, C. B. Nancrede (rarely), C. B. Porter, J. Ransohoff (rarely), M. H. Richardson, L. A. Stimson, L. M. Tiffany, W. W. Van Arsdale, A. Vander Veer (rarely), J. C. Warren, F. S. Watson, H. R. Wharton (rarely), J. W. White (Barker's operation), G. Woolsey, and J. A. Wyeth (rarely).—(41.)

*Analysis.*—Analysis of these opinions on the general ground of the advisability or non-advisability of operation would show seventeen, or  $23\frac{6}{7}$  per cent., as deliberately opposed to it, nine, or  $13\frac{1}{7}$  per cent., as urging it in all cases, in which competent surgical skill can be rendered amid suitable surroundings, and forty-one, or  $56\frac{3}{4}$  per cent., as recommending arthrotomy and suture in selected cases, such as those having wide diastasis, comminution, extensive joint distention, etc., while four, or  $5\frac{4}{7}$  per cent., favor the use of Malgaigne's hooks. Of the total number, then, over 70 per cent. favor operation in some cases. A procedure which numbers so many supporters must certainly be said to have an established place in surgery, and we may therefore proceed



to the consideration of its dangers, limitations, methods, and results.

*Dangers.*—In addition to the general risks attending any operative procedure of this nature, the danger from anæsthesia, bronchitis, pneumonia, nephritis, and the like, we have the risk of sepsis from infectious arthritis. In order to estimate as accurately as possible the mortality, I lay before you tables showing the cases which I have been able to gather since the publication of Dennis's paper. These number 711, of which 474 came to me in personal communications, while 237 are collected from published papers.

Those personally communicated represent accurately the work of the surgeons who have favored me with them, and must be acknowledged as presenting valuable statistics. The cases gathered from literature are all to which I have been able to gain access. This latter table is doubtless incomplete, but much effort has been made to render it accurate, and it is thought that no cases have been duplicated. For purpose of comparison the operations for recent, simple fracture have been taken from Dennis's paper and placed in a separate class. It will be remembered that this paper of Dennis dealt with compound fractures as well as with those of long standing. I am indebted to Dr. Hobart E. Warren, of Denver, for his careful compilation of these tables, which are as follows:

TABLE I.  
CASES FROM DENNIS'S TABLE.

Name.	Number of Cases.	Satisfactory Result.	Marked Stiffness and Disability.	Complete Ankylosis.	Amputation.	Deaths.
Beauregard . . .	1	1				
Bernays . . . . .	1	1				
Bloxam . . . . .	3	3				
Bryant . . . . .	1	1				
Bull . . . . .	2	2				
Cameron . . . . .	2	1	1			
Coley . . . . .	1	1				
Dennis . . . . .	5	4				1 delirium tremens and Bright's disease.
Finke . . . . .	1	1				
Fluhrer . . . . .	1	1				
Fowler . . . . .	1					1 carbolic acid poisoning.
Hardie . . . . .	4	4				
Hinton . . . . .	1	1				
Jessop . . . . .	2	2				
Katzenmeyer . . .	2	2				
Keyes . . . . .	1	1				
König . . . . .	3		3			
Lammiman . . . .	1	1				
Langenbeck . . . .	1					1 pyæmia.
Langenbuch . . .	1	1				
Lauenstein . . . .	1	1				
Lediard . . . . .	1	1				
Lister . . . . .	5	5				
Lynch . . . . .	2	2				
Macewen . . . . .	2	2				
McBurney . . . . .	1	1				
Phelps . . . . .	3	3				
Pozzi . . . . .	1		1			
Ranke . . . . .	1		1			
Rivington . . . . .	1	1				
Rose . . . . .	3	2	1			
Rosenbach . . . .	2	2				
Schede . . . . .	1			1		
Schneider . . . . .	1	1				
Smith, J. . . . .	1		1			
Smith, S. . . . .	3	3				
Socin . . . . .	1	1				
Timme . . . . .	1	1				
Trendelenburg . .	1	1				
Van der Meulin . .	3	3				
Wahl . . . . .	1	1				
Walsh . . . . .	1	1				
Wright . . . . .	2	2				
Wyeth . . . . .	1				1	
Total . . . . .	75	62, or 82%	8, or 10%	1	1	3, or 4%

TABLE II.

CASES PERSONALLY COMMUNICATED TO THE AUTHOR.

Name.	Number of Cases.	Form of Operation.	Satisfactory Result.	Marked Stiffness and Disability.	Cause of Death.
Abbe . . .	3	Open arthrotomy.	3		
Barton . . .	2	"	2		
Briddon . . .	2	"	2		
Bontecou . . .	3	"	2		1 sepsis.
Bryant . . .	18	"	17		1 delirium tremens.
Burrell . . .	3	"	3		
Carmalt . . .	4	"	4		
Czerny . . .	2	"		2	
Carson . . .	1	"		1	
Davis . . .	6	"	6		
Dennis . . .	25	"	25		
Fluhrer . . .	30	"	30		
Fowler . . .	37	"	30	7	
Gallaudet . . .	7	"	6	1	
Gerster . . .	3	"	3		
Gussenbauer . . .	4	"	4		
Halsted . . .	15	"	15		
Hartley . . .	27	"	23	4	
Homans . . .	2	"	2		
Horwitz . . .	{ 3	"	3		
	{ 5	Barker's	5		
Kocher . . .	24	Open arthrotomy.	22	1	1 sepsis.
Lane . . .	3	"	3		
McCosh . . .	2	"	2		
Moore . . .	5	"	5		
Owens . . .	6	"	5		1 both patellæ operated ; multiple injuries. Patient did not die because of suppuration in knee-joint.
Park . . .	10	"	10		
Phelps . . .	101	"	95	6	
Pilcher . . .	15	"	15		
Porter . . .	7	"	7		
Stimson <sup>1</sup> . . .	70	"	70		
Tiffany . . .	4	"	4		
Van Arsdale . . .	1	"	1		
Warren . . .	3	"	3		
Watson . . .	2	"	2		
White . . .	15	Barker's	15		
Woolsey . . .	4	Open arthrotomy.	4		
Total . . .	474		448, or	22, or	4, or
Percentage			94%	4%	.84%

<sup>1</sup> I judge some of those to have been done by the peripatellar suture.—AUTHOR.

TABLE III.—CASES GATHERED FROM LITERATURE

Name.	References.
Butlin . . . . .	St. Bart. Hosp. Jour., 1887.
Kesteven . . . . .	Lancet, 1887, Vol. ii, p. 259.
Macewen . . . . .	ANNALS OF SURGERY, 1887, Vol. v, p. 177.
Rhoades . . . . .	Med. Press and Circular, 1887, Vol. ii, p. 371.
Ranneft . . . . .	Nederl. Tijdschr. v. Geneesk., 1887.
Bloxam . . . . .	Lancet, 1888, Vol. i, p. 621.
Buchanan . . . . .	Med. and Surg. Reporter, 1888, Vol. lix, p. 399.
Ceci . . . . .	Deuts. Zeits. f. Chir., Bd. xxviii. p. 245; Centr. f. Chir., 1888, p. 464.
Pochhammer . . . . .	Deuts. Militärärztes Zeits., 1888, Vol. xviii, p. 442.
Wight, J. S. . . . .	Brooklyn Medical Journ., 1888, Vol. i, p. 112.
Armstrong . . . . .	New York Med. Journ., 1889, Vol. i, p. 174.
Beck . . . . .	St. Petersburg Med. Wochens., 1889, p. 48.
Fridge . . . . .	New Orleans Med. Journ., 1889-90, N. S., xvii, p. 102.
Leahy . . . . .	New Zealand Med. Journ., 1889-90, Vol. iii, p. 162.
Parkes . . . . .	Archiv f. klin. Chir., 1889, p. 447.
Poland . . . . .	Lancet, 1889, Vol. ii, p. 1230.
Pickering . . . . .	British Med. Journ., 1889, Vol. i, p. 410.
Tachard . . . . .	Bull. et Mém. de la Soc. de Chir. de Paris, Vol. xv, p. 371.
Macewen . . . . .	Pilcher: ANNALS OF SURGERY, 1890, Vol. xii, p. 400.
Smith, S. . . . .	Idem.
Stankiewicz . . . . .	Przegląd lekarski, 1890, No. 5; Centr. f. Chir., 1890, p. 23.
Cæsari . . . . .	Gazzo d. ospit., 1891, Vol. xvi, p. 633; Centr. f. Chir., 1892, p. 72.
Croft . . . . .	Lancet, 1891, Vol. ii, p. 177.
Monod . . . . .	Bull. et Mém. de la Soc. de Chir. de Paris, Vol. xvii, p. 798.
Reclus . . . . .	Idem, p. 706.
Barker . . . . .	British Med. Journ., 1892, Vol. i, p. 425.
Gibb . . . . .	Idem, Vol. ii, p. 791.
Berger . . . . .	Bull. et Mém. de la Soc. de Chir. de Paris, Vol. xviii, p. 563.
Page, H. W. . . . .	Trans. Clin. Soc. London, 1892, Vol. xxvi, p. 224.
Müller { Schönborn { Mikulicz . . . . .	Inaug. Disser., Königsberg, 1889; Centr. f. Chir., 1892, p. 414.
Velo . . . . .	Rif. Med., 1892, Vol. iv, p. 74.
Cowell . . . . .	Clin. Journ., London, 1893-94, Vol. iii, p. 394.
Ballance . . . . .	Trans. Med. Soc. London, 1894, Vol. xvii, p. 341.
Mahr . . . . .	Inaug. Disser., Munich, 1894, Centr. f. Chir., 1894, p. 989.
Cant . . . . .	Quar. Med. Journ., Sheffield, 1895-96, Vol. iv, p. 42.
Trendelenburg . . . . .	Beiträge zur klin. Chir., Vol. xii, Centr. f. Chir., 1895.
Lenger . . . . .	Cf. Mon. A. Crickx.
Crickx, A. . . . .	Monograph, Le Massage et la Suture osseuse dans les Fractures de la Rotule, 1896, Bruxelles.
Desguin . . . . .	Idem.
Gallet . . . . .	Idem.
Lavisé . . . . .	Idem.
Van Engelen . . . . .	Idem.
Cook . . . . .	Clin. Journ., London, 1896-97, Vol. ix, p. 263.
Lejars . . . . .	Presse Méd., March 30, 1897.
Lucas- Championnière . . . . .	Journ. de Méd. et de Chir., June 25, 1897.
Marsh (St. Barth. Hosp.) . . . . .	British Med. Journ., 1898, Vol. i, p. 613.
Riedel . . . . .	Quoted by Fowler.
Total . . . . .	.....
Percentage . . . . .	.....

SINCE THE PUBLICATION OF DENNIS'S TABLE.

Number of Cases.	Form of Operation.	Satisfactory Result.	Marked Stiffness and Disability.	Complete Ankylosis.	Death.
4	Open arthrotomy.	4			
1	"	1			
1	"		1		
3	"	3			
1	"	1			
1	"	1			
1	"	1			
5	"	5			
2	"	1			
2	"	2			
1	"	1			
3	"		3		
1	"	1			
2	"	2			
1	"	1			
1	"	1			
1	"	1			
1	"	1			
8	"	8			
8	"	8			
4	"	4			
1	"	1			
2	"	2			
1	"	1			
1	"	1			
5	Barker's method.	5			
1	"	1			
1	Open arthrotomy.	1			
1	Barker's method.	1			
13	Open arthrotomy.	13			
1	"	1			
5	Butcher's method.	4		1	
6	Open arthrotomy.	6			1 pulmonary embolism due to thrombosis of femoral vein.
1	"				
3	"	3			
20	"	19		1	
23	"	23			
4	"	4			
6	"	4	1		1 tuberculosis of knee-joint.
1	"				1 delirium tremens.
4	"	3	1		
1	"	1			
1	Barker's method (cerclage).	1			
6	Open arthrotomy.	6			
49	"	47			2, 1 chloroform; 1 gout and uncontrollable vomiting.
28	"	28			
1	"				1 chloroform.
237	.....	223, or	6, or	2, or	6, or
..	.....	94%	2%	1%	2½%

TABLE IV.—SUMMARY OF OPERATIONS FOR RECENT, SIMPLE FRACTURE OF THE PATELLA.

Source.	Total Number of Cases.	Satisfactory Result.	Marked Stiffness and Disability.	Total Ankylosis.	Amputation	Death.	Deaths from Sepsis.
I. Dennis's table, New York Medical Journal, April 3, 1886. <sup>1</sup>	75	62, or 82%	8, or 10%	1, or 1%	1, or 1%	3, or 4%	1 from sepsis.
II. Cases personally communicated to the author.	474	448, or 94%	22, or 4%			4, or .84%	3 from sepsis.
III. Cases gathered from literature since the publication of Dennis's table.	237	223, or 94%	6, or 2½%	2, or 1%		6, or 2½%	None from sepsis.
IV. Classes II and III combined	711	671, or 94%	28, or 3%	2, or 1%		10, or 1.4%	3 from sepsis.

As the summary shows, the mortality in the personally communicated cases has been four out of 474, or a little less than 1 per cent., while of the cases gathered from literature six out of 237 died, or 2½ per cent. If we add the figures, we have a total of 711 with ten fatal cases; three succumbed to sepsis, while the remainder died from other causes.

This mortality of 1.4 per cent., when contrasted with the 4 per cent. of deaths in Dennis's table, shows a definite decrease in the ratio during these later years. If, now, we analyze these deaths from sepsis, we find that both Kocher's and Bontecou's were in the earlier years, while Owens's was in a case of fracture of both patellæ, the patient having sustained added injuries. Certainly, so far as sepsis goes, this record of three deaths and no amputations out of 711 cases seems to indicate that the operation is a safe one; but the question may well be asked whether this represents the true mortality. I must admit that I do not believe that it does. I have trustworthy knowledge of three deaths from sepsis following this operation during the past year, each in the practice of a skilled surgeon, and each in a well-equipped and modern hospital. I am further obliged to add that I am

<sup>1</sup> The remainder of the 187 cases collected by Dennis were operations for compound fracture or fracture of long standing.

acquainted with one case of amputation for septic arthritis, this following an operation done by a house officer in one of the larger hospitals of our country, but I also know of a considerable number of cases in which the result was in all ways excellent. So that my estimate of the mortality would be that at most it is less than 2 per cent., and that the deaths from sepsis would be rather less than one in 100 of all operations.

Of the general results more will be said in detail a little later; but it may not be amiss to call your attention at this time to the fact that of the total number of cases but 3 per cent. came out with marked stiffness and disability, and something less than one-half of 1 per cent. with complete ankylosis.

*Limitations attending the Operation: Selection of Cases.—*

As one reads the personal opinions cited in the foregoing pages he is struck by the number who emphasize the fact that only surgeons of, if I may use the term, exceptional judgment and skill, working amid the most perfectly controlled surroundings, equipped with all that goes to make complete asepsis, and with the aid of carefully trained assistants should undertake this operation. It is one which entails exceptional responsibility on the operator. It is done for a condition which does not threaten life and in which non-operative methods give fairly satisfactory results. It therefore devolves upon him to select his cases with the utmost care and to surround himself with all possible resources. Patients submitted to this operation should be of a suitable age, let us say under fifty-five years, and should have healthy viscera. This is imperative. In general, one may say that those who are obliged to pursue arduous occupations, occupations which necessitate much standing or walking, may be subjected to operation more readily than those who are not dependent on good knees for a livelihood. Fracture of both patellæ is, I think, a decided indication for operation. Further, the amount of separation between the fragments may guide one in deciding to operate; in general, it may be said that if they can be

brought within one centimetre of each other operation is contraindicated. In all cases the matter should be submitted to the patient and explained to him as thoroughly as may be.

*Time of Operation.*—Operators differ in this, Fluhrer and others would operate immediately after the receipt of the injury, while Fowler strenuously advises waiting until the acute symptoms have subsided. The latter correctly says that contusion of the tissues about the joint diminishes their vitality, and that in such instance a little sepsis may spread with great rapidity. The same view is taken by Beale (*Treatment*, January 27, 1898), who says that operation should be performed immediately after the fracture has occurred only when the two following conditions can be observed together,—namely, that blood has not begun to be effused and that no direct violence has been done to the part. There is no doubt that a few septic organisms do occasionally gain access to our wounds, but they are so few that their destroyers are able to cope with them. They will almost certainly overcome them in healthy tissue, but they may not be able to do so in tissue whose vitality is impaired and which is the seat of early inflammatory changes.

Whatever the time adopted for the operation previous sterilization of the operative field should be most thorough, and it must be remembered that in many cases this is very difficult. The skin over the knees of laborers, especially those who follow such occupations as carpet-laying, scrubbing floors, shoemaking, etc., is apt to be thick and rough and creviced; the cleansing of it should be scrupulously cared for.

*Operative Procedures.*—Aside from the mechanical aids to close apposition of the fragments, Malgaigne's hooks, the steel rivets of Kittredge, Bruns, and Schumpert, the various methods (Robson, Marshall, Anderson, Myles) of passing pins through the tendon of the quadriceps and the ligamentum patellæ, or the fragments themselves, while endeavoring to avoid opening the joint, none of which have met with much favor, we have two principal methods of operation.

The first, which may be termed the procedure of Lister,



boldly opens the joint, empties it of clots, and sutures the rent in the capsule as well as the fragments of the patella. The other is exemplified by the Barker operation, and is a subcutaneous, or rather percutaneous, cerclage of the bone. This latter procedure is described as follows: After aseptic cleansing a tenotome is thrust into and through the ligamentum patellæ in its midline antero-posteriorly and a small cut made. Through this opening an appropriate needle is carried in and up behind the fragments, and made to emerge through the skin just above the upper fragment, the fragments being apposed and steadied. The needle, threaded with stout, aseptic silk, is now withdrawn, leaving the thread behind the bone. It is reintroduced and passed up in front of the fragments and out at the upper hole, threaded and withdrawn below. The fragments are brought well together, friction used to displace clots, etc., the silk ligature tied, and the knot buried. White, of Philadelphia, who has employed this method fifteen times, and who speaks well of it, begins passive motion on the tenth day, gets the patient out of bed wearing a light plaster splint at the end of the third week, and says that good use of the joint may be expected in from eight to ten weeks or earlier. We have but few recorded cases of this operation, but these seem to show no casualties. However, it is well to note that White says (*ANNALS OF SURGERY*, 1895, Vol. xxii, p. 661) that while none of his cases have had the least after-trouble, he knows of cases in other hands in which septic arthritis has followed this operation and the patients barely escaped with their lives. White's ultimate results were far better than he had obtained by the older methods, and he urges the adoption of Barker's procedure in all cases.

Of similar plan is the method of Ceci (*Deutsche Zeitschrift für Chirurgie*, 1888), who employs a percutaneous suture encircling the fragments; that of Butcher (*British Medical Journal*, 1892, p. 904), which differs but little from Ceci's; Kocher's (since discarded by the Berne surgeon himself), in which the thread was tied over a cushion of rubber or cork in front of the bone; Volkmann, who used a form of cerclage;

Aitken, who drilled the fragments longitudinally and withdrew a thread which he tied subcutaneously.

The peripatellar, percutaneous suture was, I think, extensively used by Stimson, who seems to have given it up in favor of the operation described by him. I fail to see wherein lie its advantages; it certainly exposes the joint to the risk of infection; it cannot deal with the fibrous tissues which, we have seen, are almost always interposed between the fragments; it does not reunite the lateral tears, and it does not clear out the joint clots which are so prone to organize and lead to a low grade of arthritis. If any operation be advisable it would seem that open arthrotomy should be the one selected. Of this there are numerous modifications, but the principle is simply that of free incision, removal of clots and fibrous tissues from the breach, and suture of what needs to be reunited.

It is needless to repeat that the most painstaking asepsis and the aid of competent assistants are imperative. The incision may be the original longitudinal one of Lister, or the transverse cut between the fragments, or a flap turned up from below, as done by Lucas-Championnière, or the U-shaped flap with its attached base below. When the incision is directly in front of the callus a refracture or a rupture of the callus may tear the attached soft parts and so make this second break a compound one. To avoid this some operators have proposed a vertical incision on the side of the patella; but to this latter the objection is made that it may be difficult to deal with the torn aponeurosis of the vastus on the opposite side. The vascular supply to the knee is so free that it is hardly probable that a flap turned up or down will slough, and such incision certainly answers all indications admirably. I have said that it is favored by Lucas-Championnière; he is an ardent advocate of operative procedure, and has paid much attention to the details of the operation itself.

Most operators remove all clots from the joint, either by wiping them out with sterile gauze or by gentle salt irriga-

tion. Antiseptic solutions are uncalled for, a sterile saline solution answers all indications, these being, indeed, simply mechanical. Some writers lay stress on not disturbing the blood, but I fail to see why their advice should be followed. Risk of sepsis is certainly less when the joint is empty, and we have all reason for thinking that the blood organizes and forms adhesions. The prepatellar tissues which have fallen into the breach are to be carefully trimmed away, the fractured surfaces may be cleansed of clots and, if need be, freshened. The lateral tears are to be accurately sutured, preferably with catgut.

As to uniting the bony fragments themselves a multitude of ways have been set forth. They may be drilled and joined with absorbable or non-absorbable sutures. A single thread may be used, or one on each side. The holes in the fragments may go through the posterior surface of the bone or they may stop just in front of it. Some operators of wide experience content themselves with suturing the soft parts at the front of the fragments. If silver wire be used (and this, from its tensile strength, seems the best of the non-absorbable sutures), it may be tightly twisted, and the ends hammered down in the crevice between the fragments. Silkworm gut has been used. Heavy, chromicized catgut or kangaroo tendon make an excellent suture when one is sure of their sterility. Fowler applies hooks devised by him, these to be removed at an appropriate time. Lejars (*Presse Médicale*, 1897, p. 125) uses cerclage when one of the fragments is very small or when comminution is present. The wire is passed through the tendon of the quadriceps close to the upper fragment and equidistant between its anterior and posterior faces; then it surrounds the fragments going close to the bone through the ligamentum below. Berger (*Gazette Médicale de Paris*, 1897, p. 306) and others speak well of this cerclage. It is, as Lucas-Championnière says, simply a modification of the operation of arthrotomy and osseous suture. When it is employed the soft parts in front are sutured with catgut.

Comminuted fragments are to be left or removed ac-

cording to the judgment of the operator. Inability to approximate the fragments is exceedingly rare in these operations for recent fractures, but it may necessitate scoring or division of the quadriceps muscle or its tendon, as has recently been done with marked success by Wyeth and Erdman in cases of long standing, or transplantation of the tubercle of the tibia as cleverly carried out by Keen.

Employment or absence of drainage will also depend on the individual judgment of the operator. Drainage has two excuses,—imperfect hæmostasis and doubtful asepsis. It seems to me that the surgeon whose resources and methods warrant him in undertaking this operation should be able to dispense with it.

The skin sutures and confining splint may be removed on the eighth or tenth day, but at that time it is best to commence massage and passive as well as active motions. I believe early motion to be highly desirable. It prevents adhesions, the massage preserves the quadriceps. At the end of the third week the patient may be up and about; he should wear a check apparatus until the joint has such free flexion that danger of refracture is practically gone. This will be, perhaps, at the end of the third month, but he should have resumed active life much before this. It is well for us to remember that almost all of the refractures take place during the first year. We see, then, that this operative management is not purely operative, but rather synergistic; a combination of open suture and massage.

*Immediate and Remote Results of Operative Management, and Comparison of these Results with those attained without Operation.*—So far as the immediate results are concerned there is but little difficulty in arriving at an opinion. We have seen wherein lies the danger to life and limb, and we learn from the tables which I lay before you that at the time of discharge 94 per cent. of 711 operated cases were in a satisfactory condition. I have already referred to the fact that so many reported cases were operative results, but that they did not permit of judgment as to end results. For this reason

I placed the table marked "Satisfactory" at the head of the list rather than one marked "Perfect," for the number which could be accurately grouped under the latter caption would be misleading. So far as immediate results go I question whether operation offers much of a gain over the Dutch massage method. By either form of treatment the patients resume daily life much earlier than when treated by the older methods. In the personally communicated opinions set forth in the foregoing pages it will readily be seen that the consensus of opinion goes to show that operation saves a goodly amount of time to the patient when compared with confinement measures.

But in the ultimate history of the limb the condition of the callus plays a most important part. A fibrous callus tends to stretch and ultimately to break, and while I have thought it best to discard the term bony union, the history of these cases goes to show that if the union be so complete as to render independent mobility of the fragments impossible, it is improbable that it will become incomplete or such as to allow of their mobility.

That osseous suture gives by far the greatest percentage of complete union is evident, and, further, I am convinced that it gives the smallest percentage of refractures, a matter of no small importance. This matter of refracture has been carefully studied by Bégouin and Audérodias (*Gazette Médicale de Paris*, 1897, p. 505), who cite thirty cases from Ham ("En nadeclen van de Behand," etc., Amsterdam, 1893) and add five personal cases, each of the thirty-five treated by massage and followed for a sufficient length of time. In 8 or 22 per cent. there was subsequent rupture of the callus. In a complete search of literature these authors find but seven iterative fractures after operation. (Reported by Peyrot, Lucas-Championnière, Mounod, Mayo-Robson, Stimson, and themselves.) While this number of cases is far too small to permit of conclusions, it is a fact that the closer the union the less is the danger of refracture, and it must be seen that

reuniting the vasti relieves a certain amount of the strain brought to bear on the quadriceps tendon.

Stumpff ("Inaugural Dissertation," Berlin, 1894) analyzed twenty-eight cases of refracture, and found that in seventeen the callus gave way, in seven the bone was fractured anew, in two the tendon parted. Crickx found in thirty-one cases treated by massage 25 per cent. of refractures, and in 249 cases (from Hamilton, Bull, Le Coin, Howe, Ham) managed by the older confinement methods 13 per cent. of refractures. He therefore concludes that massage gives a greater percentage than any other method, but his conclusions seem to me hasty and based on too few of the massage cases. Surgeons who have performed a considerable number of these patella operations emphasize the rarity of refracture, yet we still need large series of cases followed for a sufficient length of time. Until we get this our conclusions will be mainly inferential.

And inferential as well must be our conclusions regarding ultimate results. While Halsted, Abbe, and others place all of their results under the head of "perfect," most of the observers have lost sight of their cases at the end of the second or third month. I have therefore used the term "satisfactory" as embracing all cases in which the result was better than moderate stiffness and disability. The word "excellent" might be used here, I think, in the sense in which Bull used it. Of the 711 cases definitely reported the result is placed as "satisfactory" in 94 per cent. I should like to get nearer to accuracy in this important matter, but it is impossible to do this until the cases are reported after the lapse of at least a year, while two years would be a better limit.

We are not to overlook the fact that there are practically no arguments against operative procedure on the part of those who have accorded it a fair trial, and this must be taken into consideration in weighing such a matter. Rose, of London, writing in the "Year-Book of Treatment for 1898," says: "The open treatment of fractured patella is still looked upon askance by many, but it is gaining ground as the most certain

means of securing perfect apposition and union of the fragments." This, I am inclined to think, expresses the matter pretty clearly.

My own opinion in this matter is made after a study of the literature and the personal communications embodied in this paper, for I have never operated on a recent, simple fracture of the patella, and, indeed, began the study of the subject with something of a prejudice against operation.

That the procedure has a well-fixed place in surgery seems plain. I believe it should be done only by adepts in surgical art; that it should be confined to healthy individuals of suitable age; that its dangers and advantages should always be fully explained to the patient; that it should be reserved for fractures presenting a diastasis of over one-half of an inch or with extensive lateral tears of the capsule,<sup>1</sup> and that it should always be supplemented by early massage and mobilization of the joint. The preferable form of operation is open arthrotomy. The suture of the soft parts should always be carefully made; such suture may be applied to the bone as the operator's judgment may dictate. Such cases as are not suitable for operation may best be managed by the Dutch massage method, and this form of treatment may well be adopted by the general practitioner who thinks it inadvisable to undertake operative measures.

<sup>1</sup> Wicky says that these lateral tears are easy of recognition from the joint-distention and bulging.



## THE USE OF RUBBER GLOVES IN OPERATIVE SURGERY.<sup>1</sup>

BY CHARLES MCBURNEY, M.D.,

OF NEW YORK,

SURGEON TO THE ROOSEVELT HOSPITAL.

DURING the last few years the conviction has constantly become deeper and more widely spread among surgeons that the important agents of wound infections are to be sought for among the palpable objects which come in direct contact with the wound. We no longer dread the invisible dust which floats to a greater or lesser degree in every atmosphere;<sup>2</sup> we feel much more indifferent than formerly in regard to the material with which our operating rooms are walled and floored; and most of us do not object to the presence of numerous spectators, dressed in ordinary clothing, and coming from unknown surroundings, provided only that there is no personal contact between them and ourselves, our assistants, our patient, and our armamentarium. What we do insist upon is that the part of the patient which is to be oper-

<sup>1</sup> Read before the New York Surgical Society, March 9, 1898.

<sup>2</sup> The writer does not claim that atmospheric dust is free from harmful germ-life, but he does assert that, clinically, no evidence exists that such dust causes wound infection. If it did, we should never have a continuous series of perfect wound healings, for we make no real provision now against the entrance of dust into wounds. Every exposed object receives dust, and so also does every open wound, but while in a culture medium the germs contained in such dust will develop, similar particles that lodge in a wound fail to cause infection. At the same time, as we do not know the limit of tolerance, all reasonable provision against dust accumulations should be made, by having for operating-rooms smooth, non-absorbent, washable floors and walls, and by excluding dust-laden draughts.



ated upon shall be surgically clean, and that every object which is to come in contact with the wound or its immediate neighborhood, whether it be hand, instrument, sponge, ligature, or dressing, shall be as sterile as is possible. Not only do we insist that these objects shall be sterile at the beginning of our operation, but we make every effort to keep them sterile until its finish. In other words, so far as the wound and its immediate surroundings are concerned, most surgeons to-day endeavor to work aseptically, using antisepsis beforehand only to secure aseptic conditions at the beginning of an operation. No matter what improvements in surgical technique may be made in the future, it is certain that they will always be in the direction of obtaining and preserving more perfect asepsis in the direct handling of the tissues involved in a wound. Not only for the sake of simplicity, but also for the sake of scientific accuracy, is it desirable, in discussing the methods of operating and preserving asepsis, to discard minutiae which are unimportant or even irrelevant, and to concentrate our attention upon those details which actually determine the invasion or exclusion of wound infection. That this has been the tendency of surgeons ever since they became thoroughly familiar with the teachings of Lister is shown by the disappearance of carbolic acid spray, of caustic and irritating douches, of iodoform powder and medicated dressings as applied to clean wounds, and of a host of applications, each of which has had its advocates as being favorable for all cell-growth excepting such as was septic. I should not like to be understood as underrating the importance of paying the closest *intelligent* attention to details, but it should never be forgotten that one of the cardinal principles of good operative surgery is simplicity. For instance, respirators need not be worn by the surgeon, because if his breath is infectious he should not operate. He need not cover his head and his beard to prevent loose particles from falling on the wound, because his hair and his beard should be short and clean. He need not operate in a glass case, because the ordinary atmosphere will not produce infection in the wound. He does not require a

special foot-spigot for his basin, because he can turn an ordinary faucet safely by using a sterilized towel. Sufficiently good nail-cleaners can be made of other material than orange-wood. The impropriety of douching a clean wound with bichloride solution, and of powdering an aseptic suture-line with iodoform, need not be dwelt upon.

Fortunately, most of the objects that come in direct contact with wounds made by the surgeon can be rendered perfectly sterile, and not only sterile, but also non-irritating to the tissues. The use of heat, our most reliable disinfectant, has favored the attainment of this object more than any other improvement that has been made, and our instruments, ligatures, towels, and dressings can all be made perfectly sterile. It is but rarely now that a wound infection is attributed to catgut, although a few years ago that accusation was common. I use catgut as much to-day as I ever did and have no fault to find with it. But I can remember cases of wound infection the cause of which, I felt confident at the time, was imperfect catgut. This conclusion was reached by a process of exclusion, and yet careful examination proved the catgut to be sterile. In former years I have often heard it said that a wound had become infected through some one's carelessness at the first change of dressings. My conviction to-day is that operation wounds are *never* infected at the first change of dressings, unless, indeed, some actually soiled implement or material be thrust into them. I am entirely certain that a dozen men, all of whom have on the same day attended very septic cases, may, without causing the least infection, be present at the performance of any operation, if they do not come in actual contact with any person or object directly concerned in the work. I believe it is not too much to say that floors, walls, ordinary dust floating in the air, spectators and distant objects in general, *never* cause infection of operation wounds. If this statement is accepted, it is not difficult to reach a definite conclusion in regard to the guilt or innocence of the individual objects which *are* liable to cause wound infection, for most

of them can be tested accurately, and their sterility or their infectious condition determined. There is no difficulty to-day in having absolutely sterile clothing, water, sponges, towels, ligatures, sutures, instruments, and other utensils. If these sterile objects are manipulated with a proper regard for aseptic technique they never in themselves cause disturbance of healing. My conclusion is that the real source of infection of a wound deliberately made by a careful surgeon, who uses perfect materials and handles them perfectly, is to be sought either in the skin of the patient or in the hands of those directly concerned in the operation. I think there are good reasons, of a purely clinical character, for believing that the skin of the patient is seldom the source of operative wound infection. In the first place, many operations of emergency, when prolonged preparation of the patient's skin cannot be made, furnish us with perfect results, if in other respects the surgical technique is perfect. Then, in every operation at which the skin is incised, its deepest layers, its hair-follicles, and sweat-glands are laid bare and brought into direct and indirect contact with the rest of the wound. The cut edges of skin are frequently squeezed and contused with forceps, and are at the last pierced through and through with needles and sutures, and often enough partially strangulated by too tightly tied silk or catgut. Surely, if the skin of the patient were a very guilty party, we should rarely, with such provocation, see a perfect wound healing. It is also well known that such operations as can be done without having the fingers touch the wound at all give very clean results, and yet even in such operations the patient's skin is cut and squeezed with instruments and penetrated with sutures at many different points, and the forceps which pick up the skin also pick up the deeper tissues. It is very probable, at least, judging by clinical experience, that the patient's skin is seldom an active factor in determining the infection of operation wounds. In fact, the hand is left nearly alone to prove its innocence. To convict it we have only to call the witnesses, and they are numerous. If we had no other evi-

dence, the unceasing active discussion, both by surgeons and bacteriologists, in regard to the best method of sterilizing the hands in preparation for an operation would be nearly enough. And yet even to-day there is no unanimity in regard to the best method, the directions which are given varying from the simple use of soap and warm water up to eight different applications, calling for an expenditure of from fifteen to thirty minutes. It is not necessary for me to refer here in detail to the evidence in regard to the hands, which is given by the bacteriologist. We are all familiar with the list of organisms to be found upon the fingers, and with the difficulty of so cleansing them that they will stand the test of bacteriological examination. Even after a hand has been brought to the condition of surface sterility, we know that deeper layers of epidermis, such as may readily be opened during the maceration accompanying any large operation with frequent washings, still contain many bacteria. I think it remains to be shown that a hand which is, on the surface, sterile at the beginning of an operation remains in that perfect condition up to the end. When one considers the number of hands employed in large operations, often as many as ten or twelve, each one of which may be a source of infection; when one considers also the different qualities of the skin, the different characters and habits of the individuals, the different things which they have handled, and even the diseases they may be the subjects of, the problem of providing perfectly sterile hands at every operation becomes appalling. Moreover, in hospital practice, and often, too, in private work, the hands employed in operations are frequently changing, and every few months new hands are introduced, the possessors of which have only just begun to learn the method of cleansing them. Some of these hands come in daily contact with old wounds and with various discharges, and are necessarily more difficult to sterilize than others. And I cannot resist the conviction that the hands of some individuals are much more likely to convey infection than those of others, perhaps not continuously so, but often

for prolonged periods. At least I am familiar with more than one instance which to me demonstrates the truth of this observation. Certainly the handling of infected tissues, and any method of hand-cleansing which roughens or cracks the skin, render *perfect* hand sterilization exceedingly difficult or impossible. Many careful observers claim that it is totally impossible to render any hand perfectly sterile, and in this opinion I heartily concur. It seems to me that the real difficulty is that, in all our attempts to sterilize the hands, we are naturally prevented from utilizing our most powerful sterilizing agent,—namely, wet heat. Why not then cover the hands with a material that can be boiled? This process of reasoning led me, about a year ago, to look carefully into the use of India-rubber gloves. I was well aware that they had been used previously for special reasons, or on special occasions, by others, and I had myself used them and had had one or more assistants use them at different times when the hands had been cracked or fissured, or especially infected.<sup>1</sup> But it was only in April last that I determined to use them systematically. My experience in the matter of wound infection had been similar to that of many others. A most satisfactory series of perfect wound healings would be broken in a totally inexplicable manner by a positive wound infection. Or a number of wound infections would sometimes follow one another much too closely to be excused as unavoidable accidents. At the same time, I had made use of the best known methods of hand sterilization, and had tested the various materials made use of at my operations. These were all found to be sterile, but the hands were certainly not uniformly and continuously perfect. In

<sup>1</sup> My friend, Dr. Halsted, chief surgeon to the Johns Hopkins Hospital, tells me, in a personal communication received very recently, that since 1891 all assistants at his operations have been expected to wear gloves. He has a high opinion of their value as a means of avoiding wound infection.

In the *Centralblatt für Chirurgie*, May 22, 1897, is a communication from W. Zoege von Manteuffel, of Dorpat. This writer highly recommends the use of India-rubber gloves in special classes of cases.

April last I began the *constant* use of rubber gloves, and had my first assistant, whose hands especially came in contact with the operation wounds, also use them. At first I thought that the difficulty had been solved, for the wound-healing was remarkably perfect. But in the course of three months there were several imperfect wounds, not serious or dangerous, but positively imperfect. I then made up my mind that my system was not sufficiently complete, for, while my first assistant and I both wore gloves, my other assistants, who handled instruments, ligatures, etc., did not. Since the middle of October, immediately on my return from my summer vacation, I and all my assistants have worn rubber gloves at *every operation of every kind*, and the service has been a daily one of great activity. In private practice I have followed the same plan. The result has been most gratifying. The list of operations includes a large variety, such as for gall-stones, operations upon the intestines, hernias, nephrectomies, extensive breast amputations, thyroidectomies, amputations, resections, for hæmorrhoids, harelip, cleft palate, urethral strictures, appendicitis, etc. That is to say, a set of operations such as test the value of methods for avoiding sepsis, and test also the use of the hands and the sensitiveness of the fingers in palpation. All of the cases operated upon, both in hospital and private practice, from October 19 up to the present date, have been carefully observed with a view to the detection of the slightest infection. A large number of the wounds have been immediately closed without other drainage than a small bit of thin rubber tissue inserted at one or at two angles. Solutions of bichloride have not been used in any case, and iodoform has been applied only to wounds already infected before operation and in operations about the rectum. The only douche used has been sterilized salt solution of the strength of  $\frac{6}{100}$  of 1 per cent. Excepting that rubber gloves have been worn at every operation, and that the hands have been merely washed in soap and water, *no change* in any of the methods or details in connection with operations have been made within a year. During the period

referred to, of about five months, the only instances of even slight wound infection were the following: In each of three cases, one in private practice and two in the hospital, a single drop of pus was found at one suture puncture at the *second* change of dressings. This was wiped away, and at the third dressing no sign of the incident remained. In a fourth case, a child, from whom I had removed a small tuberculous gland in the neck, a small quantity of clear serum escaped on the fifth day. A few days later this was slightly turbid, and I then discovered, just inside the opening, a bit of rubber tissue which had broken off of the piece of tissue used for drainage. In a fifth case, a very debilitated elderly patient, for whom I did a laparotomy and intestinal anastomosis, and who had an actively discharging artificial anus at the time, a distinct cold mural abscess without rise of temperature developed on the tenth day. This was the only case which required even partial separation of the sutured skin wound. When I say that no infection occurred, I mean that no reddened wound edges, no cedematous tissue, no delayed union or unhealthy discharge, with the exceptions referred to above, occurred in a single instance. In a number of cases already infected, such as suppurating and discharging glands of the neck, requiring the use of both knife and curette, the wounds have been completely sutured and closed like originally clean operations. All of these wounds have healed primarily, and in no one of them has any part of the suture line given way or any discharge occurred. Even actively suppurating spaces, such as occur about a diseased appendix, have seemed to me to invariably heal, although of course, by granulation, in a much more perfect manner than usual. Of course, the observations of men in regard to what constitutes wound infection may be different according to the standard of measurement. I have made use of the highest clinical standard that I know of, and I can truthfully say that I have never before seen such uniformly perfect wound healing of such a high grade. Even "primary unions" differ in quality. I do not mean to assert that similar perfection has not been reached by others while



operating with naked hands, but I personally have never been able before to achieve such results. On this comparatively limited experience, I feel justified in saying that, for my own work, no change of methods has ever been so completely and delightfully satisfactory as the use of India-rubber gloves while operating. The advantages of the method are these:

The gloves can be boiled, and so, when the operation begins, they are absolutely sterile. To demonstrate the possibility of having an absolutely sterile hand I have subjected specimens of rubber gloves, such as I use in operating, to the following test. The gloves were sterilized in the usual way, two of them by boiling and one of them in the dressing sterilizer at the Roosevelt Hospital. Dr. T. M. Cheesman was kind enough to prepare jars of sterilized beef broth and to superintend the preparation of the specimens. The jars were opened, and the gloves immersed, in the instrument room at the hospital. Two of the specimens are three weeks old, and have been kept at a uniform temperature of 80° F.; one of them is eight days old and has stood in a temperature of from 65° to 75°. The jars are all perfectly free from bacterial growth. Such a test as this is, of course, a very severe one. The condition of the hand is determined by taking a number of scrapings from its surface. But if it were to be tested as thoroughly as these gloves have been, it would be necessary at least to immerse a large part of the hand in the culture fluid for hours. What method of sterilizing the hands would permit such a test to be successfully made? As the gloves are non-absorbent, they must, if they touch no infected object, remain sterile *throughout* every clean operation. In the course of the operation blood can be rapidly and completely washed off from their smooth surface with a sterile solution.

No matter to what previous use the operator's hands may have been put, he may begin his operation without dread that they may cause infection. The same protection may be secured in the case of assistants and nurses, even when these are inexperienced. Although having a suppurating lesion on



his own hand, the surgeon may operate with impunity on his patient.

The rubber gloves add very greatly to the operator's comfort. In the first place, he avoids the loss of time and the annoyance caused by a prolonged effort to sterilize his hands. He simply washes his hands and puts on the sterile gloves.<sup>1</sup> When he removes his gloves his hands are perfectly clean and soft and his nails free from discoloration and cracking. No matter how septic the case he is obliged to operate upon, he is protected against infection. Not once during this past winter have I suffered from a crack in the skin of my hands. I have been frequently asked if it is not very difficult to manipulate instruments, ligatures, etc., with gloves on the hands. At first it is rather difficult, and at first one is liable to tear or prick the gloves. But like most of the things we do, what is difficult at first soon becomes easy through habit. Needles can be threaded, instruments can be used, ligatures can be tied just as well and certainly nearly as rapidly with gloves on as without them. I have also been often asked if the sense of touch is not so blunted, when the hands are gloved, as to interfere with accurate palpation. I do not find this to be the case. I have had no difficulty from that source in any instance. One can feel a very feeble pulse perfectly well while wearing a well-fitting rubber glove. The same is true of adhesions, slight differences of consistency, irregularities of surface, etc. One reason for this is that the hands of the operator who wears gloves are never hard and callous or roughened by contact with irritating disinfectants, and the sense of touch is therefore more acute.

<sup>1</sup> Dr. Halsted writes me as follows: "We boil our gloves now, of course, and from the boiler they are dropped into large basins of corrosive sublimate solution (1 to 1000), filled with this solution by the surgeon who is to wear them, and, while full, drawn on his hands, which have been as carefully disinfected as if no gloves were to be used."

Clinically I have found it to be perfectly satisfactory to simply wash the hands in soap and water and put on the sterile gloves. One learns to avoid cutting and tearing the gloves, which accidents would expose an unsterilized hand.

When tissue, as a portion of intestine, is very slippery, a piece of sterile gauze renders it at once manageable. If thick pedicles have to be tied with force, a piece of gauze prevents the ligature from cutting the gloves. If a glove finger is accidentally cut or pricked, the wound is at once closed by putting over it an extra glove finger. The gloves are not expensive, and they last, with daily operating, from four to six weeks. The method of preparation that I formerly made use of was this:

The gloves were boiled for one-half hour in a 1-per-cent. solution of soda. They were then washed off in hot sterile salt solution to remove any remnants of sulphur which showed after the boiling. Lightly packed with sterile gauze to dry the interior, and, wrapped in a sterile towel, they were ready for use at any time. My gloves are now prepared as follows: They are first thoroughly washed with soap and hot water, to which a little aqua ammoniæ has been added. They are then boiled for fifteen minutes in a 1-per-cent. soda solution. Being carefully removed by means of sterile forceps from the hot soda solution, the gloves are laid in the centre of a sterilized towel, which is folded over them. This enveloping towel is not opened until the individual who is to wear the gloves is to put them on. Operator, assistants, and nurses put on a fresh pair of gloves for every operation. I have given up trying to dry the interior of the gloves by packing with gauze, as this process is laborious, requires some handling, and seems to be unnecessary. If the hands are quite dry, and are then well rubbed with dry sterilized starch, the gloves can be drawn on quite easily even when their interior is moist. If the hands are moistened with glycerine, or with a material called *lubrichondrin* (made from sea moss), wet gloves can be easily put on. Oily lubricants are damaging to India rubber. Filled with any sterile fluid the gloves permit the hands to enter readily. If this last method is made use of, the hands should be first sterilized, as the fluid which filled the glove flows out and over its outer surface as the hand enters. Before putting the gloves on, the

hands are rapidly washed in an ordinary way with soap and water and dried. To remove any starch which may have fallen on the outside, the gloved hands are washed off with sterile salt solution. During the operation, blood and other fluids can be very rapidly washed off as often as one chooses, or a fresh pair of gloves can be put on at any moment in case of accidental contamination. During active military and naval service India-rubber gloves would be of the highest value. When rolled up they occupy a very small compass, and can be rapidly sterilized over and over again in any small vessel which can serve as a boiler. The best methods of sterilizing the hands would be totally impracticable in a rapidly filling army hospital, but provided with a few pair of gloves, the army or navy surgeon need never dread that he may infect the wounds, which he treats and makes, with his hands. The gloves may be prolonged into gauntlets, and in order that for certain cases the whole forearm may be covered, I have had armlets made which extend from the wrist to the elbow. The presentation which I have made of this subject is based almost entirely on clinical experience. I find that with the aid of "boiled hands" I can obtain in my own work such uniformly perfect wound healing as I did not believe before was possible. Those surgeons who already, with naked hands, have entirely satisfactory success, certainly do not need rubber gloves. But I am sure that they will be useful to those who too frequently meet with imperfect results. If some of the latter will give the method a fair trial, its level as an addition to our defences against wound infection will soon be properly estimated.

OSTEOTOMOCCLASIS: A PRELIMINARY NOTE ON  
A MODIFIED OPERATION TO CORRECT  
CURVED TIBIA.<sup>1</sup>

By W. BARTON HOPKINS, M.D.,

OF PHILADELPHIA,

SURGEON TO THE PENNSYLVANIA HOSPITAL.

As indicated by the name suggested, osteotomocclasis, the operation to be described consists of combining in a modified form both the operations of osteotomy and osteocclasis to correct a curve or bend of a long bone resulting from congenital malformation, rickets, or vicious union after fracture. Briefly stated, two operations are done, incomplete osteotomy and osteocclasis. At the first operation the bone is divided with a chisel not completely, but through more than one-half of its thickness at its inner curve. After the skin wound has healed, but before repair of the bone has sufficiently advanced to restore the original strength at the weakened point, a period easily included between one and three weeks, the osteoclast is applied, and the deformity corrected by a fracture in the bone at its weak point. The only case upon which the operation has been performed is the following:

S. M., a healthy Italian girl, aged three years, was admitted to the Pennsylvania Hospital December 29, 1897, with bow-legs. The legs were evenly and markedly bowed, so much so that she crossed them in walking. January 10, 1898, under ether, both tibiæ were chiselled half through from within outward, but no attempt was made to break the bones. The small skin incisions were neatly closed with fine catgut sutures, and each was dressed simply with a small pad of gauze, no splint being applied.

<sup>1</sup> Read before the Philadelphia Academy of Surgery, February 7, 1898.



FIG. 1.—Osteotomoclasis.



FIG. 2.—Representing appearance of bones two months after osteotomoclasis.



FIG. 3.—Showing condition of bones immediately after osteoclasis. The fibulae are excessively bent by a retaining bandage.



FIG. 4.—The osteoclast.



January 21, eleven days later, the child was again etherized, and the deformity of both legs was readily corrected with the osteoclast, very little force being required to effect this result. Though both bones yielded with an audible snap, the fracture in each proved to be incomplete, as shown in Fig. 1. This excellent skiagraph was taken while the patient was still under ether. Careful scrutiny will demonstrate (1) the chisel cut of two weeks' standing, having undergone no apparent process of repair; (2) fracture of the bone from a point corresponding to the bottom of the chisel cut, to the approximately neutral axis of the bone; and (3) the bending of the remaining portion of the shaft.

The limbs were encased in plaster of Paris.<sup>1</sup>

The possible advantages of combining, at times, osteotomy and osteoclasis were suggested to me by the conditions observed to have been produced by performance of simple osteoclasis for pronounced bow-legs in a sturdy child of eighteen months, as shown in Fig. 3. The remarkable similarity of the bone lesions to those subsequently found, as shown in Fig. 1, readily accounting for the suggestion. In this case the bones yielded with an audible snap, revealing a fracture which on removal of the osteoclast proved to be incomplete in both tibiæ. The inner half of the shaft will be seen to have parted while the outer half is only bent, the continuity of the bone remaining, therefore, to this extent intact. Considerable force was required, but the pads placed upon the three pressure-plates of the osteoclast prevented any bruising or damage of the soft parts. The knee pad rested on the inner aspect of the head of the tibia, the ankle pad upon the inner malleolus, while the apex pad was placed at the middle of the leg. Each of the three pads was kept in

<sup>1</sup> March 17, 1898, nearly two months later, the dressings were removed and the limbs found to be firm and straight.

Figure 2, taken at this time, affords an interesting study of the skiagraphic appearance of the bone lesions under conditions of absolute fixation. If osseous opacity to X-rays correspond to osseous density, which we have no reason to doubt, the processes of repair have more than fulfilled their work in restoring the lost continuity of the bone which existed, as indicated by the shaded points, especially in the right tibia, at the site of operation.

accurate position by strips of rubber adhesive plaster, which held the pressure-plates, pads, and limb firmly together.

In studying the action of the osteoclast some familiarly known principles relating to the strength of bodies and their resistance to force may be referred to. Letting a square beam of wood represent the shaft of a bone, discounting for the time the variations in form which modify its strength, the manner in which an osteoclast exerts its force would test the transverse strength of such a beam. The transverse strength of a beam is represented by two elements, its resistance to compression of one-third of its thickness and its resistance to extension of the remaining two-thirds. The line of equilibrium at which compression terminates and extension begins, being the neutral axis. "The limit of stiffness is flexure, and the limit of strength or resistance is fracture." The limit of stiffness is more easily reached than the limit of strength; if, therefore, a transverse cut is made in the beam on the side to be stretched, the latter will be weakened relatively more than by a similar cut made on the side to be compressed. The side to be stretched or extended will be fractured whether a cut is made or not, the continuity of the beam being preserved, if at all, at that portion which is only flexed, not broken. What is true of a beam of wood is, so far as present purposes are concerned, equally true of the shaft of a bone. Partial section, therefore, as described, would seem to be a rational preliminary step to osteoclasis by reducing many times the force required by the latter and by locating accurately the point of fracture. The use of the osteoclast to supplement the work of the chisel, where, as in hospitals, this rather cumbersome apparatus is available, is, for reasons presently to be mentioned, advantageous. Whether in certain cases osteotomy may be made a safer operation by combining with it osteoclasis as a subsequent step is a question which can only be decided by experience. In children so poorly nourished and unhealthy that traumatism of any kind is likely to provoke suppuration, the danger of a bone section cannot be ignored. It is in cases, therefore, whose general

condition in prudent hands negatives the performance of osteotomy, that I venture to propose the modification of the latter I have suggested, as for them I believe it would prove safer. Osteoclasis, although having fallen to a great extent into disuse, is especially useful for correcting trifling curves in tender bones in children whose parents cannot go to the expense and trouble of apparatus necessary for a cure by gradual means. Intelligently employed it is neither haphazard nor barbarous, and should not in my opinion be allowed to become an obsolete operation. But our subject relates to that class of cases to which simple osteoclasis is inappropriate, either because the bone is too hard or the apex of deformity is too near a joint to yield to a degree of force which can without risk be applied; suitable cases, in other words, for osteotomy. To claim, without qualification and with such scant data as we have before us, that the operation under consideration is safer than osteotomy would be premature, and would be making an unfair and prejudicial comparison with a most valuable, safe, and tried measure. This much, however, may be said; that osteotomy causes a compound fracture, the modified method a simple fracture; osteotomy produces usually a complete fracture, while by the modified method the fracture is incomplete; after osteotomy fixation is required immediately, by the other method no fixation is required, during the existence of a wound; when suppuration occurs after osteotomy, which, however, it rarely does, it is complicated with loss of continuity in the bone,—a suppurating compound fracture. Should suppuration occur after the first step in osteotomoclasis it would involve only a bone cut, not a bone section, and would be surgically far less serious than if accompanied by loss of continuity. Following the second step, after the skin-wound has entirely healed, there is of course no risk of suppuration, as the fracture produced is a subcutaneous one. Osteotomy, on the other hand, requires only one etherization, while the modified method requires two. The osteoclast shown in Fig. 4 is the one which has been used in these

cases. It is very simple, easily adjusted, and powerful, but is not particularly original. The two counter-plates and the C-shaped clamp can be placed at any point desired on the pair of shears, and retained by binding screws beneath. The apex plate is swivelled to the clamp screw. The pressure plates present concaved faces and have flanges on their lateral borders to secure the necessary pads in position. It may be said of instrumental osteoclasis that it possesses the great advantage over what may be called manual osteoclasis, in that the force used with it is under perfect control, ceasing instantly the bone yields, producing thereby usually an incomplete or green-stick fracture, while the force applied by manual effort, on the contrary, cannot be so controlled, but goes on with a rush when the resistance of the bone ceases. After osteotomy, in applying the plaster-of-Paris dressing, I always prepare to open a small trap-door by placing a wall of lead ribbon around the wound. Through this, should it become necessary to obtain access to the latter, a window can readily be cut. In healthy children this is, however, a very rare contingency, as primary union is almost invariably the rule.

The excellent skiagraphs accompanying this paper were taken by Dr. Starbuck at the Pennsylvania Hospital.

[Dr. Hopkins remarked, in closing the discussion on his paper, "The fact that in four cases which came under the observation of one Fellow of the Academy evil consequences resulted from osteotomy proves, I think, that there are certain dangers in the operation to be guarded against, which, as I have stated, should not be ignored."]

## TRANSACTIONS OF THE NEW YORK SURGICAL SOCIETY.

*Stated Meeting, March 9, 1898.*

The President, ANDREW J. McCOSH, M.D., in the Chair.

### SYMMETRICAL GANGRENE OF THE LEGS IN RAY- NAUD'S DISEASE; DOUBLE AMPUTATION.

DR. GEORGE E. BREWER presented a young man, an inmate of the City Hospital, who, in November, 1897, developed symmetrical gangrene of both feet, which progressed so rapidly that it was found necessary to amputate both legs below the knees, the operations being done simultaneously. Dr. Joseph Collins, who had seen the case in consultation, pronounced it one of advanced Raynaud's disease.

An interesting feature of the case was the mental condition of the patient, which was one of partial dementia. He was unable to give his name or age, and no previous history of the case is obtainable. He stated, however, that he had once been out all night and frozen his hands and feet. At the time of his admission to the hospital the patient was badly nourished and extremely weak. Since the operation his mental symptoms, particularly the sensory aphasia, have slightly improved.

Dr. Brewer said that cases of this character are very rare. He had been able to find only two similar ones on record, one reported by Professor Osler and one by a German writer. It has been supposed that the mental torpor was due to a vasomotor disturbance of the brain, similar to that which, in the extremities, produced the gangrene.

The patient's statement regarding freezing the feet was at first accepted in the hospital, until the fact was recalled that up to the time of the development of the symptoms there had been no weather cold enough to justify such a conclusion. Dr. Collins's explanation, therefore, seemed far more reasonable.

KRASKE'S OPERATION FOR CANCER OF THE  
RECTUM; INTESTINAL ANASTOMOSIS BY  
MAUNSELL'S METHOD.

DR. BREWER presented a woman who had been admitted to the City Hospital last spring. She was suffering from a cancerous growth of the rectum. Previous to her admission she had been an inmate of another hospital, where colostomy had been performed.

An examination showed that the lower third of the rectum was surrounded by a large mass, which extended so high up that its upper border could not be reached with the finger. A week or two later, while examining the woman again under an anæsthetic, the speaker said he was able to get his finger above the mass, which almost completely occluded the gut and extended well into the recto-vaginal wall. A few days later an operation was undertaken for the removal of the cancerous growth, Kraske's method being followed. It was necessary to resect the coccyx and the lower two segments of the sacrum on the right side.

After the operation the patient's general health improved very much, and she gained about twenty pounds in weight. Subsequently, a second operation was undertaken for the relief of a prolapse of the rectum, and after that wound had healed her fæcal fistula was closed, at her request. This fistula was about two inches in length, and in order to close it, it was necessary to resect four inches of the sigmoid flexure. The functional result was fairly good. The patient now wears a little pad which covers the external opening of the rectum, and has only one movement of the bowels per day. Maunsell's method was resorted to in performing intestinal anastomosis after resection of the bowel.

It is now nine months since the operation, and there is as yet no sign of a recurrence. The specimen was exhibited, which showed a solid tumor, completely encircling the lower third of the rectum, and involving the posterior vaginal wall. Microscopic examination showed it to be an adenocarcinoma.

INTESTINAL ANASTOMOSIS BY MAUNSELL'S  
METHOD.

DR. BREWER also presented a woman, who was admitted to the hospital last April, suffering from pain and tenesmus, which

was supposed to be due to a stricture of the rectum. The rectum was the seat of a number of well-marked ulcerations and a stricture, which was located about three inches from the anus. An attempt was made to dilate this, but without success. The patient was then put under an anæsthetic, and a thorough examination revealed a fusiform mass in the left iliac fossa, which was supposed to be a carcinoma of the sigmoid flexure. On opening the abdomen extensive adhesions were found, which were the result of an attack of peritonitis seven years previous. The sigmoid flexure was the seat of marked infiltration, which extended well into its mesentery and also to the pelvic floor,—clearly an inoperable condition, as the condition was then regarded as unquestionably carcinomatous. The wound was closed and colostomy done to give temporary relief. By the following October the patient's health had improved so much that she asked to have her colostomy wound closed, and an examination at that time revealed almost no evidence of the former induration. Subsequently a second laparotomy was done, which showed that the sigmoid was quite normal in appearance: the infiltration surrounding it had also disappeared.

It was then decided to close the colostomy wound, and in order to accomplish this it was necessary to excise about three inches of the sigmoid, and then complete the anastomosis by Maunsell's method. The case presented unusual difficulties on account of the dense adhesions. The patient has since been well, with the exception of the recurrent strictures of the rectum.

The speaker said that, in his opinion, the marked induration of the sigmoid flexure and the tissues surrounding it, in his last case, was of syphilitic origin, because subsequent to the first laparotomy the woman developed very severe headaches, which were relieved by large doses of potassium iodide. She had received no syphilitic treatment prior to that time.

DR. L. A. STIMSON referred to a similar case which had come under his observation. The patient was a man, thirty-five years old, who had a large mass occupying the transverse colon, which was regarded as a malignant growth. The condition was considered inoperable, and as there were no obstructive symptoms, nothing was done. Six months later another surgeon opened the abdomen, also thought the growth inoperable, and made a lateral anastomosis. Three years later the man died, and at the



autopsy no trace of the growth could be found. There was no syphilitic history.

DR. ROBERT F. WEIR said he had seen the case mentioned by Dr. Stimson. In that instance the patient had undergone a previous operation for hernia, and a mass of omentum had been tied off, which was supposed to have given rise to this inflammatory mass, which afterwards disappeared.

The speaker called attention to the fact that in rare instances actinomycosis may bring about this matting together of the tissues in the abdominal cavity, and that this condition may disappear under the administration of potassium iodide.

DR. JOSEPH D. BRYANT said that not infrequently large masses of this kind are found associated with the intestines, where some irritative process has prevailed for some time, particularly in connection with the appendix. Cases have been reported where such masses have been mistaken for malignant growths.

#### ANEURISM OF EXTERNAL ILIAC ARTERY; TREATED BY LIGATION OF COMMON ILIAC.

DR. CHARLES MCBURNEY presented a young man who, last summer, after lifting a heavy weight, felt a pain in the neighborhood of the left groin; a few weeks later he noticed a tumor in that region, which gradually increased until it attained the size of a closed fist. The tumor began below, at Poupart's ligament, and extended well up into the abdomen. It presented all the characteristics of an aneurism. The general circulation of the left limb was good.

On account of the high situation of the aneurism it was decided that ligation of the common iliac was necessary. After making a large, median, abdominal incision the peritoneal cavity was opened, and the artery tied by the transperitoneal method. In order to reach the vessel it was necessary to lift out the intestines.

Immediately after the ligation, which was done with a double catgut ligature, pulsation in the aneurism ceased, and its sac rapidly diminished in size. The opening in the posterior peritoneum over the artery was not closed separately. The operation was done on December 18, 1897. The patient was then put to bed, with the leg elevated and protected from cold. The wound



closed by primary union. Pulsation has never returned in the aneurism, and its site can now only be determined by the existence of an induration just above Poupart's ligament. There was never any disturbance of the integument from interference with the circulation. The man was discharged on January 25, 1898. He is able to work, but still complains of some weakness in the left leg.

DR. JOSEPH D. BRYANT said that about five years ago, at St. Vincent's Hospital, he saw a patient with a large aneurism of the external iliac artery of the right side, which had been present for a long time, and gave rise to much distress. In order to cure it, it was deemed expedient to ligate the common iliac on the right side. There was some difficulty in finding the artery, as it lay considerably farther towards the right side than usual,—so much so that the left common iliac, which was also misplaced, was nearly ligated instead. The patient's general condition was very poor, and he died three days after the operation. At the autopsy it was found that the aorta rested and bifurcated on the right instead of the left side of the lumbar vertebræ, so that the usual relations of the vessels had been somewhat transposed. This anomaly, Dr. Bryant said, occurs about once in every twenty cases.

DR. WILLY MEYER reported a case where, after tying the internal iliac arteries for hypertrophy of the prostate, he found it necessary to tie the common iliac on account of the occurrence of secondary hæmorrhage on one side. He used silk sutures for the ligation, because catgut cut the artery twice. The operation was followed by partial gangrene of the toes.

#### AMPUTATION AT HIP-JOINT FOR RECURRENT SARCOMA.

DR. MCBURNEY presented a young negro who had been operated on a number of times for extensive recurrent sarcoma of the left thigh. The growth was of the connective-tissue variety and did not involve the bone, but on account of its tendency to recur it was finally decided to amputate the limb at the hip-joint. In performing the operation, he adopted the following preliminary measure in order to control the hæmorrhage. An incision, such as he recommends in removing the vermiform appendix in recurring cases, was made through the skin of the abdomen, at

a point about one and a half inches internal to the anterior spine of the ilium, parallel with the fibres of the external oblique aponeurosis; the muscular fibres were then separated as in removing the appendix by blunt dissection until the peritoneum was reached. The peritoneum was then opened, and through this opening the common iliac artery was firmly compressed by the finger of an assistant. The amputation was then completed without any difficulty, and without appreciable loss of blood.

Dr. McBurney said he had resorted to this method of controlling hæmorrhage in several amputations at the hip-joint and had called the attention of the society to the method on other occasions. To a certain extent it simplifies the operation, rendering it almost a bloodless one; furthermore, it leaves the operative field clear, and in that respect is superior to the introduction of pins, as the latter sometimes prevent a very high amputation. There is also less danger of any complication. By compressing the common iliac we control every artery that goes to the stump, and during ligation of the vessels the assistant can occasionally raise his finger, thus enabling us to rapidly identify the smaller bleeding vessels without difficulty.

Dr. McBurney said that another drawback with which we are confronted in hip-joint amputations is the large bony cavity, the acetabulum, lined with cartilage, that is left after removing the femur. In order to obviate this, he suggested that it would be a good plan to scrape the cavity, and then fill it with a large chunk of muscle, which is still attached and vascular. In the case just presented he did not find it necessary to resort to this expedient, as the disease was confined to the soft parts, and therefore the head of the femur was not removed. Section of the bone was made through the femoral neck. The consequence was that immediate closure of the deep wound took place.

DR. ALEXANDER B. JOHNSON said that in several cases of amputation of the hip by Dr. McBurney he had been the assistant who compressed the common iliac. He could testify that it was not difficult to control the bleeding in this manner.

DR. ROBERT ABBE said he had employed this method of compressing the common iliac in a very high amputation at the hip, and he considered it the best expedient that he had thus far resorted to. The control of the bleeding was excellent, and the absence of all pins and the constricting ligature was a decided advantage.

DR. WILLY MEYER said he had had occasion to employ this method in a case that had been operated on a number of times previously for hip-joint disease. The patient was a man, aged thirty years, who had sinuses traversing the hip in all directions, so that the application of pins and rubber tube was out of the question. By compressing the common iliac from within the peritoneal cavity the bleeding was controlled without difficulty. The amputation consumed some more time than usual, as there was firm bony ankylosis between the shaft of the femur and the acetabulum.

#### TREPHINING FOR TRAUMATIC EPILEPSY.

DR. A. J. MCCOSH presented a boy, eleven years old, who, when he was twenty-two months old, had an otitis media, followed by a mastoiditis, for which he was trephined. The operation was followed by partial paralysis of the left arm and leg, which has persisted ever since. He also has wrist-drop and talipes equinus on the left side. His ear healed, and he remained comparatively well for eighteen months. When he was three and a half years old he had some cerebral symptoms, restlessness, irritability, and crying out at night, and soon afterwards he developed convulsions, sometimes as many as ten a day, which were more marked on the left side than on the right. He was trephined again in October, 1894, and for twenty-two months subsequent to the operation he was entirely free from convulsions. The particulars of that operation cannot be ascertained, excepting that the opening was made in the right motor area. After twenty-two months his convulsions recurred, his paralysis somewhat increased, and his mental condition was also impaired.

On January 9, 1898, Dr. McCosh made an incision over the right motor area, and on dissecting up the scalp he found a circular opening in the skull, which was filled by a mass of dense connective tissue: a layer of this, about one-eighth of an inch thick, was peeled off, and it was observed that from its under surface there were prolongations of connective tissue, which projected into the convolutions of the cortex. The brain convolutions in this region were very much atrophied, and this condition extended for some distance beyond the opening in the bone. The connective tissue was removed as completely as possible, and then a piece of rubber tissue was inserted underneath

the skull and over the brain: outside the skull a plate of celluloid was placed. The scalp was then sutured over the plate. On the morning following the operation the boy had a series of very violent convulsions, and subsequent to that another attack, which was milder. His mental condition has slightly improved.

[The wound healed by primary union. Brain pulsation cannot be felt through the celluloid plate.]

In reply to a question, Dr. McCosh said that the opening in the skull in this case was about an inch and a half in diameter.

Dr. McCosh presented a second case, one of traumatic epilepsy, which he had already reported at a recent meeting of the society (February 9, 1898), in connection with a specimen shown at that time. The specimen consisted of a mass of fragments of rubber tissue, which Dr. McCosh had found amalgamated with a layer of dense connective tissue in an old trephine opening. It was removed, together with the cicatricial tissue surrounding it, representing altogether a tumor the size of a small walnut. Its removal left a cavity in the third frontal lobe about one and a half inches long, one inch broad, and one and a half inches deep. It was packed and drained, and the scalp temporarily closed. After forty-eight hours, when the packing was removed, it was noted that the cavity had become smaller, but as its surface looked rather unhealthy, it was not thought wise to insert a permanent plate at that time: it was thereupon covered with rubber tissue, which was left undisturbed for five days. Then the scalp was again opened, and on removing the rubber tissue it was found that the cavity had been completely obliterated, and that the brain was beginning to bulge out of the opening in the skull, which made it impossible to insert a plate underneath the bone, as had been contemplated. A plate of platinum-foil was thereupon placed outside the bone, and the scalp sutured over it. The speaker said that gold-foil has been employed in similar cases, but it is said to disintegrate.

Since the operation, which was done on February 8, 1898, the boy has had no convulsions, and there has been a marked improvement in his mental condition.

A third case was shown by Dr. McCosh. A young man, twenty-three years old, who, when he was eight years old, fell and received a scalp wound in the frontal region. Two years later he began to have fits, which were general in character, but

the right hand was always more affected than the left. He sometimes had as many as five fits a day. They were all of very short duration. During one of them, which was carefully observed by a nurse, the right fingers and thumb were tonically flexed across the palm of his hand, while the left hand and arm remained relaxed. His mental condition gradually deteriorated.

On examination a depression was found in the skull, exactly in the median line, and about two inches above the root of the nose. Over this area a T-shaped incision was made, the skin-flap raised, and a button of bone removed with the trephine. The dura was found slightly injected and thickened; it was opened and the brain aspirated, but no fluid was withdrawn. The brain tissue appeared to be less resistant than usual, but otherwise normal. It did not bulge out, as it usually does, through the trephine opening. A plate of celluloid was placed over the opening in the skull and the scalp sutured. Primary union resulted.

Since the operation, which was performed just a week ago, the patient has been perfectly well.

Dr. McCosh said that his object in presenting these cases at this time was simply to show their present status, and not to illustrate their final outcome, as too short a time had elapsed since the operations to make any predictions as to the final results.

DR. ROBERT F. WEIR said that five years ago he had shown a boy whose skull was trephined, and the opening subsequently covered with a celluloid plate, which never gave rise to any trouble. Gold-foil has frequently been employed for this purpose; but it is not to be recommended, as it disintegrates, and in one case, coming under his observation, the granulations sprang right through it. This fact was first brought to his attention by Dr. Estes, of Pennsylvania.

DR. GEORGE WOOLSEY said that he was surprised to see how soon a celluloid plate, merely laid upon the surface, became firmly fixed. About two years ago he had employed a celluloid plate with very good result. In that instance he made a kind of shelf of bone around the circumference of the large opening, on which the plate was laid in order to prevent it from slipping. In this case he had previously used a plate of gold-foil, but the latter became perforated by granulations and failed to accomplish the purposes of its use, and was replaced by celluloid. The specimen was shown to this society a year or two ago.

DR. McCOSH said that about six months ago he had a case where, during a secondary operation for traumatic epilepsy, he found a piece of rubber tissue in a very crumpled condition, although it was not quite rolled up into a ball, as it was in the other case he had related.

In regard to the use of the celluloid plate, the speaker said he had a patient who has now worn one for over two years with, apparently, perfect comfort.

He was not aware that platinum-foil had ever been used before as a covering for the brain to prevent adhesion of the scalp to the cerebral surface, but it seemed to him to fulfil the requirements better than either gold-foil or rubber tissue.

#### INDIA-RUBBER GLOVES IN OPERATIVE SURGERY.

DR. CHARLES MCBURNEY read a paper with the above title, for which see page 108.

DR. ALEXANDER B. JOHNSON said that since last spring, when he first began to wear rubber gloves while operating, he has not had infection occur in a single instance. In regard to the convenience of wearing the gloves there might be some question. While wearing them he has found it more difficult to tie silk sutures. They add slightly to the time required to complete an operation, but this drawback is more than counterbalanced by the feeling of confidence they give the operator that he has not infected his wound.

DR. WILLY MEYER said that since last summer he had adopted the use of cotton gloves in all aseptic operations and rubber gloves in septic operations. He has also adopted the plan of wearing caps and mouth-covers, as advised by Mikulicz, of Breslau. The cotton gloves possess the advantage of being inexpensive, but they do not permit as delicate a sense of touch as the rubber gloves. Dr. Meyer called attention to the fact that a surgeon should, as far as possible, avoid infecting his hands; for example, in examining the mouth, rectum, or vagina, a finger-stall should always be worn. He had them imported last fall, and they are now here in the market.

The importance of the skin, as a source of infection, should not be lost sight of: Lauenstein, of Hamburg, has found that in 60 per cent. the skin is not entirely sterile. Lately Landerer has demonstrated that a 1-per-cent. aqueous solution of formalin

seems to be the most effective disinfectant for the skin. Gauze compresses, soaked in such a solution, are put on the operating field for twelve to thirty-six hours,—to be changed once or twice within that time. With such a preparation the skin was found to be surely sterile in 80 to 90 per cent. of the cases.

DR. FRED. KAMMERER said that for the past year, since the work of Mikulicz on this subject, he has been wearing both the cotton and the rubber gloves during his operative work with excellent results,—much better than those obtained before adopting this innovation. His practice was to wear cotton gloves in aseptic and rubber gloves in septic operations. The speaker said the cotton gloves were not entirely convenient, as it was difficult to get a perfect fit at the tip of the fingers. He is now trying the rubber gloves in all operations, always at first sterilizing his hands before putting them on, and thus guarding against the possibility of infection in case the gloves are punctured. He also wears the mouth-cover spoken of by Dr. Meyer. Occasionally the necessity of removing the gloves may arise when we desire to verify something by the sense of touch. But this certainly does not militate against the use of gloves in general. If we cannot have the advantage of gloves in all cases, let us use them in as many cases as we can, and they are certainly by far the large majority.

DR. GEORGE E. BREWER said that during the past few months he had been wearing rubber gloves in his operative work with very satisfactory results. For about a year previous to that time he had been having his assistants wear gloves, leaving his own hands bare. The speaker showed a pair of very thin, seamless, rubber gloves made for him by the Goodyear Company.

In reply to a question, Dr. Brewer said that during the period when only his assistants wore gloves a number of infections in clean cases occurred. During the past four months, when both he and his assistants wore gloves, he had forty-three consecutive clean operations without infection.

DR. ROBERT F. WEIR said that in 1894 he had worn the rubber gloves for a time, but they did not prove satisfactory to him: he had found them difficult to get on, and they impaired his sense of touch, they also became readily perforated. Possibly, he thought, he did not persevere long enough in their use to test their value. The speaker called attention to the importance of thoroughly disinfecting the hands in case either cotton or rubber



gloves are used, otherwise the infectious skin-material might permeate the gloves. Buck-skin gloves with rubber tips have also been suggested for this purpose.

DR. ABBE said he had been wearing the gloves since last summer, and had found them highly satisfactory. He thought it important that the assistants' hands should also be covered, as they are very apt to come in contact with infectious material in their work in the hospital, and the hand, when once infected, is very hard to cleanse.

Dr. Abbe said that when the gloves are very tight—a little tighter than an ordinary kid glove is worn—the sense of touch is not materially impaired. The most common accident he has encountered is pricking the glove at the index-finger, but this can be avoided after a little practice. Wearing the gloves gives the surgeon a certain sense of security; besides, it renders his work more attractive, because without them, after operating on certain putrid cases, it is almost impossible to get rid of the odors on his hands, which make him feel like a social outcast.

DR. JOSEPH D. BRYANT said that about four years ago he instituted the practice of having his assistants wear cotton gloves, which had been saturated with bichloride solution during the preparatory steps of an operation, first, however, cleansing their hands, in the usual manner. He has always found it somewhat difficult to get his hospital assistants to pay proper attention to the sterilization of their hands, and for that reason he advised the use of gloves. Personally, he has used finger-stalls for some time, and he felt inclined to go a step further and adopt the gloves; but in either instance should thoroughly cleanse the hands before their use, as not infrequently unrecognized puncture happens which might carry infection in the absence of this precautionary measure.

DR. GEORGE WOOLSEY said he had tried the rubber gloves several years ago, but found them rather clumsy. They were then not made as well as those shown by Dr. Brewer, and were not very durable. Another objection was the expense, as they cost about \$3.00 per pair. The speaker thought it important that the assistants should wear gloves, even if the operating surgeon does not.

DR. MCBURNEY, in closing, said that in his paper he tried to define the causes of wound-infection and our methods to exclude



them. We have now reached a stage where we know that certain factors which were formerly considered as dangerous to clean wounds can be disregarded, and we should endeavor to simplify our aseptic measures as much as possible. For example, he did not believe that the mouth-cover or respirator, which Dr. Meyer says he wears, is necessary, because careful examinations of the breath have been made, and it has been found to be free from bacteria. So far as expectorating or coughing into the wound is concerned, that should certainly be avoided. If we can prove that any troublesome methods of guarding against wound-infection are really unnecessary and valueless, we should give them up. Dr. McBurney said there are even those who insist that the surgeon's face should be clean-shaven and his hair short: he hoped the time would not come when the order would go forth that the surgeon's hair must be long, as that would place some in an embarrassing position. The successful practice of aseptic surgery depends absolutely on the uniform careful attention to important detail, but affectations and traditions based on imperfect observations should be dispensed with, because they are useless and unscientific.

TRANSACTIONS OF THE SECTION ON GEN-  
ERAL SURGERY OF THE COLLEGE  
OF PHYSICIANS OF PHILA-  
DELPHIA.

*Stated Meeting, February 11, 1898.*

The President, DR. R. G. LECONTE, in the Chair.

FACIAL DEFORMITY FOLLOWING A BURN.

DR. W. W. KEEN exhibited a man, aged twenty-seven years, who had suffered a very extensive burn of the face and head from a gasoline explosion four years ago. The right eye was partly destroyed, and enucleation was required. There is a large scar on the front of the neck dragging down the lower jaw. Both lips were entirely destroyed. The patient is unable to chew food, but can swallow solids if finely minced. Much of the hair of the left side of the scalp was also destroyed.

HIP-JOINT AMPUTATIONS.

DR. WILLIAM H. NOBLE reported six cases of amputation at the hip-joint, for which see Vol. xxvii, page 753.

DR. W. W. KEEN has employed Wyeth's method in three cases of amputation of the hip-joint. He had not observed a troublesome amount of capillary hæmorrhage. The use of a narrow rubber tube, wrapped two or three times about the thigh, constricts such a very small area of vessels that one would not expect a great degree of vasomotor paralysis. An interesting feature of Dr. Noble's paper was the recurrence of a sarcoma after amputation at the hip-joint, the primary tumor having been situated in the tibia. This shows the necessity for the most radical treatment in these cases.

## DISABILITY AND DEFORMITY FOLLOWING FRACTURE OF THE BASE OF THE NECK OF THE FEMUR.

DR. R. G. LE CONTE showed a man, aged twenty-three years, with an old fracture of the neck of the femur simulating an outward dislocation. While lumbering nine months ago a falling tree knocked the patient on his hands and knees, the force of the blow being greatest on the left side, across the back of the pelvis, and sufficient to drive his knees into the earth for some distance. He felt something give way at the left hip. He was in bed without treatment for a month, and then got about on crutches. Present condition: Marked limp with the sensation of left hip slipping upward. Inspection shows the left foot in normal position (no eversion or inversion), but the leg is over an inch shorter than the right. On flexion of the thighs the left knee is an inch lower than the right, and Nélaton's line passes an inch below the left trochanter. All motions are restricted in the left hip; rotation shows the arc of the left trochanter smaller than the right; extension of the left leg does not move the trochanter. Palpation above the socket revealed an ill-defined mass, which was mistaken for the head of the bone. While these symptoms do not conform with those of a recent outward luxation, it is conceivable that eight months' walking since the receipt of the injury might alter many a typical symptom. A radiograph shows the head to be in the socket, the neck being at a right angle to the pelvis, short, thick, with an abundance of callus at the junction of the neck to the shaft of the bone.

## POLYPUS OF COLON.

DR. D. T. LAINE presented a man, thirty-two years of age, who, six years ago, fell from a carriage, and was struck by the rim of the wheel below the ribs on the left side. About a year after this he began to suffer from pains over the region of the stomach and slight attacks of indigestion. He now noticed, for the first time, blood in some of the stools.

Two years ago he had a severe attack of diarrhœa, accompanied by large quantities of blood and mucus in the stools. About four months ago a careful examination of the rectum, using a medium-sized Kelly speculum, revealed a small sessile growth on the anterior wall of the colon, just above or at the

sigmoid flexure. Almost two weeks ago he returned and submitted to a second examination, which showed that the growth had become somewhat pedunculated.

The object of Dr. Lainé in bringing the patient before the society was to elicit an opinion as to the best method of procedure in such a case. Should the growth be removed by abdominal section or attacked from below, or should the patient be advised to wait until the growth has developed a sufficiently long pedicle to allow of its safe and easy removal by a wire snare or *écraseur*.

DR. JOHN B. ROBERTS stated that he would be inclined to twist off the growth or to apply a ligature by means of a Gooch canula. It might be desirable to perform a posterior proctotomy in order to secure more room through which to work.

DR. O. H. ALLIS stated that the best means of diagnosis would be the introduction of the hand into the rectum, if a person could be found whose hand was sufficiently small. If the growth was benign, he would be inclined to let it remain for a time, until, perhaps, it became pedunculated, when it could be more easily reached or grasped without injuring the bowel.

DR. W. W. KEEN would advise the use of a longer and wider speculum, which he would first pass beyond the growth, then as the speculum was withdrawn the tumor would come prominently into view. He would be disposed to employ some form of *écraseur* in effecting the removal of the growth. He dissented from the view of postponing the operation, inasmuch as such growths are apt to become malignant sooner or later if allowed to remain. He described a case under his care at the present time in which the rectum was studded with adenomata. He twisted off two or three for microscopic examination. The growths were pronounced adenomata, undergoing rapid change towards malignancy. He proposed to employ the longest Kelly speculum to determine the highest limit of the tumors, and to perform a Kraske operation if the tumors were confined to the lower portion of the bowel. If he could not do this he would be disposed to wait and perform a Maydl operation when it became necessary.

#### DIAGNOSIS IN ATYPICAL CASES OF APPENDICITIS.

DR. RANDOLPH FARIES called attention to the difficulties of making a diagnosis in some cases of appendicitis, and reached

the conclusion that nothing short of an exploratory incision could enable the most expert surgeon to diagnose the true nature of the disease in some cases.

DR. O. H. ALLIS stated that surgeons are sometimes obliged to confess that they are not able to make a diagnosis, and that it is necessary to perform an operation in order to determine the nature of the trouble. He does not, however, consider such a conclusion a diagnosis.

DR. G. G. DAVIS spoke of the doubt that frequently existed in inflammatory affections of the right iliac fossa in women. He described a case upon which he had recently operated. The previous history was useless in arriving at a diagnosis. There was a spot of tenderness slightly below McBurney's point. At the operation he found the right ovary enlarged and containing about a drachm of pus. The right tube was also inflamed, and the tip of the appendix was adherent to the ovary and tube and likewise the seat of inflammation. He thought the trouble in the appendix was secondary to that of the ovary and tube.

DR. R. G. LE CONTE stated that the symptoms of appendicitis were simply those of local peritonitis in the right iliac fossa, and might be due to inflammation of the appendix, the ovary, the cæcum, or the lower portion of the ileum. In ninety-nine cases in a hundred, however, the appendix was the seat of trouble, and the knowledge of this fact enabled one to diagnose appendicitis in the vast majority of cases with considerable certainty. He did not, however, think that there were any pathognomonic symptoms in appendix trouble.

DR. J. M. BARTON had observed in a few cases that there was more apt to be vomiting in appendicular inflammation than if the ovary or the cæcum are affected. His experience, however, had not been large and the observation may have been a mere coincidence. If a large number of these cases were reported in detail, we would then be able to make some definite statements in regard to these points.

## TRANSACTIONS OF THE PHILADELPHIA ACADEMY OF SURGERY.

*Stated Meeting, March 8, 1898.*

The President, J. EWING MEARS, M.D., in the Chair.

### OPERATIVE TREATMENT OF DISABLING DE- FORMITY FOLLOWING FRACTURE OF HUMERUS AT ELBOW.

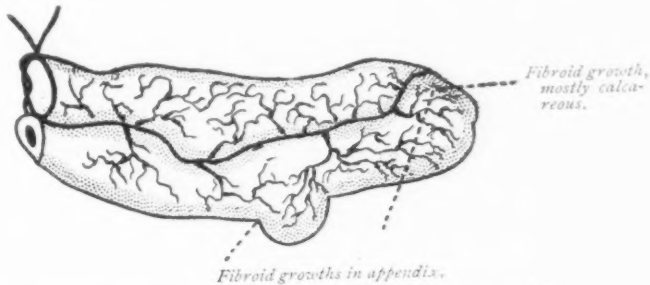
DR. JOHN B. DEEVER presented drawings and radiograms illustrating the case of a boy, thirteen years of age, who had sustained fracture of the internal condyle of the left humerus and backward dislocation of the bones of the forearm. Six months later he had nearly complete ankylosis of the injured joint. An incision over the elbow-joint anteriorly revealed the internal condyle pushed forward and surrounded by callus. The displaced and obstructing bone was chiselled away until free flexion and extension of the forearm was possible. Four weeks later the patient was discharged, having full extension, and a little more than one-half flexion.

DR. WILLIAM J. TAYLOR stated that in two instances he had operated for the relief of badly united fracture of the elbow. A very important point in dealing with such cases was to remove more bone than might at first seem necessary, for during the after-course of the case, if a large amount of bone has not been taken away, enough to make practically a flail joint, there will be a sufficient amount of new material formed to very seriously hazard the ultimate mobility of the joint.

### SUPRAVAGINAL HYSTERECTOMY FOR MYOMA.

DR. DEEVER presented five specimens of uterine myomas removed by abdominal section and supravaginal hysterectomy. The first tumor was of the size of a foetal head. No drainage. Recovery uneventful. The history of the second case was similar

to that of the first. For the third case glass-tube drainage was employed for three days. Recovery uneventful. The fourth case was a very vascular tumor, twenty-five pounds in weight, in the removal of which there was much unavoidable loss of blood and great shock. A litre of hot, normal, salt solution was left in the peritoneal cavity, and more was injected into the subcutaneous connective tissue. Death ensued shortly after completion of operation. In the fifth case a large subperitoneal mass had developed, between the folds of the right broad ligament. It was enucleated without accident, and a good recovery followed. The vermiform appendix presented two fibroid masses (see Figure), each about five centimetres in diameter; one situated at the mid-point of the organ opposite the mesenteric attachment; the other, which had undergone partial calcareous change, was situated at



Dr. Deaver's case of fibroid growths in the wall of the appendix.

the tip, within the mesenteric attachment. The appendix walls were much thickened throughout. This appendix was removed later.

Microscopic examination revealed the appendix coats greatly thickened, the lumen almost obliterated, the mucous membrane atrophic. There was great thickening of the walls of the blood-vessels with a round-celled infiltration throughout the various layers of the organ. The side of the appendix opposite the mesenteric attachment contained an encapsulated fibrous growth, which in spots showed a tendency to calcareous degeneration.

DR. GEORGE ERETY SHOEMAKER said: In the removal of fibromas Dr. Deaver has used a method which is rapidly coming to the front, and will undoubtedly replace all others,—i.e., the control of the blood-supply prior to the removal of the tumor

This is a true surgical method and is theoretically the most simple, although practically it is in some cases a great deal more difficult than it seems. Any one who is familiar with the possibilities in the way of distortion of the anatomy of the abdomen will recognize this. There are but four vessels to tie, and then one can amputate at leisure. The elements of success in hysterectomies of this type are undoubtedly the avoidance of handling the intestines and the early control of the hæmorrhage. If the arteries can be reached very early in the operation there is practically no hæmorrhage.

#### OPERATION FOR PERFORATING TYPHOID ULCER.

DR. DEEVER reported the following case of typhoid perforation: A woman, aged twenty-three years, was admitted to the German Hospital by the direction of her attending physician, Dr. W. Duffield Robinson, January 16, 1898, on account of general peritonitis, due to perforation of the bowel, which had occurred on the twenty-first day of typhoid fever. Up to that time the disease had run rather an uneventful course.

At 3 A.M., on the day of her admission, the patient was suddenly seized with violent abdominal pain; symptoms of collapse followed. There was a drop in temperature, reaching a point below normal, and a slight increase in the rapidity of the pulse-rate. The abdominal muscles soon became rigid; slight distention followed the rigidity some hours after the onset of pain. The pain continued to be general, "cramp-like," and quite severe, perhaps greatest about the umbilicus. No vomiting. She was admitted to the hospital at 6.30 P.M., and was etherized as soon as removed from the ambulance.

A small incision was made in the median line of the abdomen. On opening the peritoneum gas and pus escaped. Pyogenic membrane appeared on the small bowel in several places. Small bowel was quite adherent at the site of a perforation which, large enough to admit a small pea, was detected in the ileum, opposite the mesentery, about seven inches from the ileo-cæcal junction. This was closed by black silk sutures. The peritoneal coat of the bowel was united over the deep layer of sutures. The abdomen was flushed with warm sterile water and glass drainage inserted. Wound closed with interrupted silkworm-gut suture. Light aseptic gauze dressing. Abdomen packed with ice. Oper-



ation lasted seventeen minutes. Patient in her room at seven o'clock, with a temperature of  $101\frac{1}{2}^{\circ}$  F.; pulse, 176.

January 17: Temperature range from  $100\frac{3}{8}^{\circ}$  to  $102\frac{3}{8}^{\circ}$  F.; pulse, 172 to 128. Distention increasing; no vomiting; no bowel movement or flatus.

January 18: Temperature  $104\frac{3}{8}^{\circ}$  to  $101\frac{1}{2}^{\circ}$  F.; pulse, 152 to 142. Distention more marked. Vomited once. Sponge bath given every two hours.

January 19: Patient died at 7.40 in the morning.

Autopsy revealed "general peritonitis;" many typhoid ulcers. The sutures closing the perforation had not given way. No other perforation was found.

DR. J. EWING MEARS remarked that in cases of perforating typhoid ulcer surgical interference was not justifiable, and should not be instituted in cases in which the perforation occurs when the infective process is at its height. In mild cases of the disease, in which the pyrexia has not been of high grade and in which perforation occurs at the end of the third week or later, when the stage of convalescence is fully pronounced, laparotomy may be performed. In cases of this character Lücke's method is advised, —laparotomy with the formation of an artificial anus. Rapidity in operation will be an essential factor in the achievement of success.

#### GASTRO-ENTEROSTOMY.

DR. DEEVER reported the case of a man, thirty-one years of age, who, two years before, being in excellent health and without any gastric disorder, was struck violently across the abdomen and left arm with a wire one-half inch in diameter. About a dozen blows landed on his abdomen, as patient could not get out of the way, his back being against the wall, and the machine in front of him. With his right hand he brought the machine to a stop. He was immediately taken to his home, where it was found he had received a fracture of the lower left forearm. Patient confined to bed. On the third day he had bloody vomiting; the amount filling a washbasin and a chamber vessel. Fever continued for a day with delirium. In about a week or ten days was out of bed. From the time the vomiting set in he complained of severe pain on eating, followed by vomiting. For about a month vomiting continued three times per day, usually after eating, with very severe pain. During this time his

appetite was excellent, but he did not dare take much food on account of the severe gastralgia which followed. The pain in the epigastrium and vomiting every three or four days continued during the year of 1896 and spring of 1897. Lived on a light diet of eggs and milk. In October, 1896, had to stop work on account of weakness. On July 4 he had two attacks of bloody vomiting. The first spell contained bright red blood, the second, which followed after some hours, contained clotted blood. Vomiting and pain still continued. He lost about sixty pounds in weight.

Under ether, an incision was made in the linea alba from the ensiform cartilage to a point midway between the same and the umbilicus. A mass the size of a medium-sized orange was found at the pylorus. The extensive adhesions, the infiltration of adjoining stomach and duodenal walls, and the very bad general condition of the patient influenced him against so radical an operative procedure as excision. Stomach opened and digital examination made, which disclosed a practically occluded pylorus. A lateral anastomosis was established between stomach and small intestine by incision and suture. Abdomen closed without drainage. Uneventful recovery. The immediate result of the operation was that the patient was able to take more food, but not much solid food. There was no more vomiting, but some pain still continued.

Dr. Deaver remarked that the chief points of interest in this case were first the traumatic origin of the growth; second, the open question whether the growth be malignant or not; third, that the anastomosis was made by simple suture. It is the rarest thing for him to use any mechanical device in this operation, believing that greater good is accomplished by being able to make the orifice of communication between the parts anastomosed much larger than can be done by using most of the mechanical appliances originated for this purpose.

#### ABDOMINAL SECTION FOR GUNSHOT WOUND OF THE STOMACH.

DR. THOMAS S. K. MORTON reported the case of a man, aged thirty-two years, who was admitted to the Samaritan Hospital July 31, 1897, and discharged August 29. He was sitting in a water-closet at a suburban park when a rifle was accidentally dis-

charged in a shooting gallery near by. The ball, a conical .22 calibre, penetrated the one-inch-thick board forming the wall of the privy and entered the patient's right loin, two inches outside of the vertebral column and about midway between the crest of the ilium and last rib.

Upon admission to the hospital, a few moments later, he was found to be in a condition of severe shock, and was reported to have vomited largely of blood. External heat and stimulants were applied. Dr. Morton saw him two hours after the accident. At that time he was in slightly better general condition, and complained of excruciating abdominal pains as well as of continued nausea. Manipulation of the abdomen originated severe cramps. The ball could be felt subcutaneously about half an inch to the left of the median line midway between the ensiform cartilage and the umbilicus. The urine was drawn and found to be free of blood, so far as ocular signs were concerned. The genito-crural nerve had evidently been cut by the projectile, as complete anesthesia prevailed in the distribution of that nerve on the right side. He again vomited a quantity of blood during the examination. It was determined to at once proceed with operation without awaiting reaction, as bleeding evidently was continuing.

Ether was administered, and a three-inch incision made in the median line between the umbilicus and ensiform cartilage. Considerable free blood was found in the peritoneal cavity beneath the line of incision, and an opening in the anterior portion of the stomach was immediately discovered, owing to a circular ecchymosis about an inch in diameter surrounding it. Upon lifting the viscus a quantity of air, mucus, and clotted blood was ejected through the wound of its wall, because of a sudden contraction of the muscles of the organ, as is so often observed in handling it during operative manipulations. The wound was sutured by two stories of interrupted Lembert stitches of silk. The folds of peritoneum about the pylorus and the two omenta were distended with clots of blood, which made search for the posterior or entering wound difficult. It was determined, however, that the posterior wound was not in a free portion of the viscus, hence, while it might give rise to post-peritoneal abscess, which could be dealt with should it arise, it would not be likely, should leakage take place, to originate peritonitis. The question

then arose as to the desirability of freely incising the stomach for the purpose of discovering the wound of entrance and also to more effectually stop hæmorrhage from the gastric arteries supposedly divided by the ball in its course through the organ. But on account of the desperate condition of the man it was decided simply to carry a wick of iodoform gauze down to the pyloric region and bring it out through the partially sutured abdominal wound. This was done so that if leakage took place thereabouts it would be led up through the parietal wound.

The man made a good though slow recovery. The wicking was removed on the third day, and the portion of the wound through which it emerged healed by secondary union. The urine passed for some days after the operation contained blood in varying amounts, which led to the belief that the right kidney had also been traversed by the ball. No other symptoms of kidney injury or disease presented themselves, however, in the subsequent course of the case. He was discharged well in four weeks with a firm cicatrix but very anæmic.

At the time of the meeting the patient, who was exhibited, had regained his usual strength and color. He did not then suffer from dyspepsia or other sign of gastric ulcer, and stated that he felt about as well as ever and was able to follow his occupation,—that of leather-dresser. The cicatrix was very firm. Anæsthesia of the distribution of the genito-crural nerve remained.

#### CHRONIC OSTEITIS OF TIBIA, OF TRAUMATIC ORIGIN.

DR. J. EWING MEARS exhibited a skiagraph of an injury of the lower end of the tibia of the right leg. The patient, a young man, aged nineteen years, in climbing a picket-fence, five years ago, caught his foot between the pickets and fell. Immediately after the fall he was able to walk home, a slight abrasion alone indicated the point of contact of the ankle with the pickets—about two weeks after the receipt of the injury swelling supervened, the patient began to feel pain, and to walk lame. These conditions have continued until the present time, notwithstanding the efforts which have been made to relieve them. Local applications of all kinds—the use of fixed apparatus, the application of splints, change of climate, internal medication—have failed in

turn. An interesting feature of the case has been developed in the fact that the patient, who was sent to Denver, Colorado, for relief, could not remain in that climate on account of the severe pain he suffered. As is well known, this climate is a notably dry one, and yet it is not regarded favorable, so the patient states, for the relief of rheumatic conditions. Measurement about the ankles shows the right to be one inch greater in circumference than the left one.

The skiagraphic picture is not as distinct as desired. It shows, in a sufficiently distinct manner, however, the increase in size of the lower end of the right tibia. The evidence of fracture is not present. There appears to be a difference, whether real or apparent, between the articulating relations of the astragalus, os calcis, and scaphoid bones of the right and left foot.

Abscess of the bone has been suggested. The symptoms seem to indicate the existence of periostitis, with resultant osteitis, slight in character.

The patient now uses crutches, keeping all weight from the foot. Pain still continues. Dr. Mears proposed for relief of the condition counter-irritation, preferably by the cautery.

DR. H. R. WHARTON said that he had under his care a woman who presented somewhat the same history, and there appeared to be some thickening about the lower end of the tibia. She suffered with severe pain of an intermittent character, especially at night. He suspected some specific trouble, and put her on full doses of iodide, with which she had been very thoroughly treated already. He then thought of a periostitis, which might be relieved by a simple incision of the periosteum, so he cut down and incised. In doing this he discovered a large thickened and obliterated vein, probably the internal saphenous. He excised this and several branches of the internal saphenous nerve adherent to it, and a perfect recovery resulted, the wound healing promptly. Some months afterwards he saw the patient, who said she was entirely relieved.

#### CHRONIC COLITIS AS A SYMPTOM OF APPENDICITIS.

DR. G. E. SHOEMAKER read a paper with the above title, for which see Vol. xxvii, page 733.

DR. JOHN B. DEEVER said that he had met with more cases

of colitis in neurasthenic women with movable kidney than with appendicitis. He had operated for movable kidney under these circumstances several times. He had followed up some of these cases since, and a large percentage of them had been relieved. A movable kidney in contact with the colon is capable of exciting an irritation which will result in this condition of affairs. He also believed that the appendix was responsible for a certain percentage of cases, but did not think one could settle this matter definitely until the appendices had been examined microscopically. He had gone so far as to say that all cases of intestinal dyspepsia would get well sooner by having the appendix removed, combined with dietetics, rather than medication. There is no doubt that the rôle the appendix plays is a most important one. So far as differential diagnosis goes, Dr. Shoemaker had brought this out strongly. In cases of right-sided inflammation of the Fallopian tubes, ovarian cysts with a comparatively short pedicle twisted upon itself with gangrene of the walls, small ovarian cyst of right side having undergone suppuration, etc., is in many instances impossible to differentiate, and nothing short of an operation will disclose the actual condition of affairs. The case that Dr. Shoemaker reported proved this very well, and showed the intimate relation that the appendix held to a small ovarian cyst. Bimanual or vaginal examination would not show this. A certain percentage of tubal cases are the result of appendicitis, since the appendix is associated with the right broad ligament by another ligament, and, in addition, there is an intimate connection between the lymphatics of the two, so that infection may take place through the one to the other.

As to enterocolitis, he had operated, during the last year, on 230 cases of appendicitis, and the percentage of those with enterocolitis was very small, but there is no doubt that it does occur as the result of chronic appendicitis.

## REVIEWS OF BOOKS.

AN AMERICAN TEXT-BOOK OF GENITO-URINARY DISEASES, SYPHILIS AND DISEASES OF THE SKIN. Edited by L. BOLTON BANGS, M.D., and W. A. HARDAWAY, M.D. Large 8vo, pp. 1229. Philadelphia: W. B. Saunders, 1898.

In this large volume are included two treatises, each with its proper editor, who have both been assisted by a large corps of eminent collaborators. Each contributor is credited with the chapter furnished by him, so that the reader has the added interest of knowing the primary source of the statements that are made in the text that he is reading. Diseases of the urethra are treated of by Lydston; of the prostate, by J. William White; of the ureter, by Fenger; of the kidney, by Bolton. Syphilis receives the attention of eight different writers, and occupies 150 pages of the book. To each subject is given space enough, so that fulness and thoroughness of treatment are possible, while the names of the various authors are a guarantee of the accuracy and of the up-to-dateness of the text. A little less than 500 pages are devoted to diseases of the skin. In the preparation of these pages the editor has had the assistance of twenty-five other dermatologists. Hebra's system of classification, based on the application of the principles of general pathology to cutaneous diseases, has been in the main adopted, and in the eight classes of inflammations, hæmorrhages, hypertrophies, atrophies, new growths, neuroses, diseases of the appendages, and parasitic diseases, the various affections are marshalled. An analysis of the individual chapters would be tedious and unprofitable. It is evident that each author has striven to make a clear and authoritative presentation of present knowledge in the particular field

assigned to him. The editors have systematized the material drawn from so many different sources, and the result is this imposing volume, which may be accepted as an authority in the departments which it covers.

LEWIS S. PILCHER.

A CLINICAL TEXT-BOOK OF SURGICAL DIAGNOSIS AND TREATMENT for Practitioners and Students of Surgery and Medicine. By J. W. MACDONALD, M.D. Philadelphia: W. B. Saunders, 1898.

This is a volume which cannot but engage the interest of the practitioner of surgery, because of the many pages which set forth much valuable information. It is to be regretted that unreserved praise cannot be awarded to a work whose architecture is original, but whose plan is frail and which has many insecure sections in its structure.

Exceedingly able and satisfactory are the 200 (nearly) pages treating of the diagnosis of disease of the digestive system. They indicate broad knowledge of literature and practice. In general the section devoted to genito-urinary diseases can be commended, and the article on "Stone in the Bladder" is most thorough and deserves special mention.

The treatment of aneurisms is outlined in an indefinite way, the absence of details making this account insufficient for a student. There is an incomplete article on "Fractures" containing no originality and discussing few modern therapeutic features. The illustrations of tumors are more than usually horrible,—invariably depicting those particular examples seen rarely,—from which no practical knowledge can be obtained,—turn to pages 100 and 101. If a student or young practitioner (whose existence is made an excuse for entering many trite sentences in the work) should search for chondromata or sarcomata like those presented he might never find them, and during his long, vain quest he might omit the discovery of many menacing neoplasms. Illustrations of *types* are essential in text-books.



This author treats Dupuytren's finger contraction only by subcutaneous incisions, nor is a more radical operation mentioned in this connection. He fails to recommend incision or excision in prepatellar bursitis, except in cases complicated by suppuration. Cases of empyema of the gall-bladder are so numerous nowadays, and so important, that the disposal of this subject in one-half page of general comments is unwarranted. Excision of the tunica vaginalis is not mentioned as a mode of treating hydrocele. Rectal examination as an aid to diagnosis in cases of appendicitis with abscess is denounced, and the author has "long since ceased to employ it." Treating of the differential diagnosis of appendicitis from pelvic inflammation in females, he says, "When a mistake is made it is because the surgeon has neglected the imperative duty of making a vaginal examination." This sentence is grand and ridiculous.

The chapter given to the consideration of the X-rays does not mention any of the unpleasant sequelæ which may follow the making of the negative, nor does it detail sufficiently the practical uses of the rays. The possibility of errors in calculation when a skiagraph is used as an illustration seems not to have occurred to Dr. Macdonald.

The book as a whole, however, deserves recognition and patronage, despite its shortcomings, and that the author will advance its standard in the future we doubt not.

CHARLES H. GOODRICH.

*CHIRURGIE DU COU.* By FELIX TERRIER, Professor in the Faculty of Medicine of Paris, assisted by A. G. GUILLEMAIN and A. MALHERBE. 12mo. Illustrated, pp. 248. Paris: Félix Alcan.

A series of monographs devoted to the surgery of various parts of the body have appeared from time to time, written by Professor Terrier and his two assistants. They are now augmented by this one devoted to the surgery of the neck, and em-

bodying the teachings of the author in his course of operative surgery in the University of Paris.

The book is divided into four parts; in the first, devoted to the air-passages, the authors discuss laryngoscopy, the insufflation of the new-born, catheterization and dilatation of the air-passages, and endo- and ectolaryngeal operations, including laryngectomy.

In the second part the thyroid body and its surgery are studied; thyroidectomy, exothyropexy, and the operative indications for the relief of goitre. The third part includes the surgery of the œsophagus; and the fourth, the surgery of the vessels, muscles, lymphatics, and nerves of the neck. This last section devotes considerable space to the various methods of ligating the chief arteries and veins of this region, and, as it is fully illustrated, contains much valuable information in a small compass.

For study and preservation the value of the volume would have been increased by better paper, better printing, and better binding.

HENRY P. DE FOREST.

A MANUAL OF INSTRUCTION IN THE PRINCIPLES OF PROMPT AID TO THE INJURED. Designed for Military and Civil Use. By ALVAH H. DOTY, M.D. Second Edition. Revised and enlarged. New York: D. Appleton & Co., 1898.

This little volume is attractively dressed. The first glance tells us that it is well illustrated. The subsequent tour of inspection along its lines increases the reader's satisfaction. The author's style is simple, concise, and clear, yet without embellishments of diction; he makes each subject attractive. The chapters combining essential elements of anatomy and physiology are models of their kind. The article on hygiene (first offered in this edition) is excellently planned, and its careful wording will make this subject transparent to the dullest visions. The treatment of all varieties of emergencies is well directed. Methods of transporting the wounded, as planned by an army surgeon, are presented in detail.

CHARLES H. GOODRICH.

## CORRESPONDENCE.

### THE QUESTION OF PRIORITY IN CHOLEDOCHOLITHOTOMY.

Editor ANNALS OF SURGERY:

IN preparing my paper on the "Treatment of Gall-Stones" (*American Journal of the Medical Sciences*, February and March, 1896), and in reviewing the history of choledochotomy, I considered the case of Dr. Marcy not choledocholithotomy, but simply an operation on the gall-bladder or cystic duct for the removal of a stone. I therefore made no mention of it, as my paper treated of the surgery of the common duct only. In a letter to me, Dr. Marcy still claimed priority, and reproached me for overlooking his paper, and thus doing an injustice both to him and to American surgery and surgeons. In my answer to him I stated my reasons for not considering him in the question of choledochotomy, and expected the matter to be ended thereby. That Dr. Marcy, however, holds to his claim of priority is seen in a later publication,—*"Obstruction of the Common Bile-Duct"* (ANNALS OF SURGERY, January, 1897). Dr. Alexander Hugh Ferguson, in an article *"Personal Observations on the Surgery of the Gall-Bladder and Bile-Ducts"* (*British Medical Journal*, November 6, 1897), sustains the claim of Dr. Marcy. In order to settle the question of priority, I desire to state the facts in the case as they appear to me.

I consider the operation performed by Dr. Marcy on October 26, 1889, to have been an incision either in the neck of the gall-bladder or perhaps in a dilated portion of the cystic duct for removal of an impacted stone. I do not consider it possible that it was an incision of the common duct for the following reasons:

In the first place, the first report of Dr. Marcy's case is very imperfect. For this reason alone I could have disregarded it in the bibliography of my paper. In sifting the literature for reports of cases bearing on a certain subject, we must necessarily pass over those that are inaccurately reported, as upon them no accurate opinion can be based.

Dr. Marcy's first report of the case (*loc. cit.*) as well as a more extended later report of the same case (*loc. cit.*) show that any operation on the common duct can be excluded.

His patient, female, aged forty years, suffered with attacks of biliary colic with icterus, diarrhoea, and clay-colored stools. The abdomen being opened, the gall-bladder "like a cystic growth distended the lips of the wound." Gall-bladder sutured to peritoneum,—incised,—ten ounces of bile together with a calculus evacuated. (Dilated gall-bladder.) With a probe he felt a stone deep down, "quite beyond the cystic duct." He does not specify by measurement how far he probed, and this is important. This statement of the probe passing "quite beyond the cystic" duct is not contained in his first report in 1890, but is found in his report of 1897, published after I had raised the question of priority. This stone could not be dislodged or crushed. The gall-bladder was washed out, the stitches between gall-bladder and peritoneum cut, and the wound packed with gauze. "After having somewhat forcibly drawn the gall-bladder through it [the wound], even this procedure did not enable us to seize and remove the calculus. I then divided the walls of the duct [paper of 1890] [of the common duct (paper of 1897)] with scissors, and everted its edges from over the roughened calculus, which was even then removed with difficulty. The thickened mucous membrane of the duct (What duct? Evidently not gall-bladder, but cystic duct) and bladder was joined by a fine, continuous, kangaroo-tendon suture, and in a like manner the peritoneal edges were carefully adjusted, while over all a third layer of suturing was taken." A continuous paraserous stitch inter-

folded the edges, "the entire wound of the viscus measuring about four inches [paper of 1890]." In the paper of 1897 it reads: "The wound through the duct and gall-bladder thus closed measured four inches." Abdominal wound closed without drainage; patient recovered. "The rough, mulberry-looking calculus, grape size, was the offending member, weighing when dried fifty-nine grains."

To say nothing of the very significant changes made in the text of the second publication, and overlooking the lack of clearness and comprehensiveness in the description of the operation, it is evident that Dr. Marcy first incised the enlarged gall-bladder at its fundus. This incision was then later enlarged downward towards the neck of the gall-bladder, or to the cystic duct, for a distance of four inches.

A normal gall-bladder, containing from one to three ounces of contents, is about four inches long from the fundus to the cystic duct. A gall-bladder containing ten ounces and appearing "like a cystic growth distending the lips of the [abdominal] wound" is longer, we will say, at least, by one inch, making a total of five inches from fundus to neck. The normal cystic duct measures two inches in length. A continuous incision from the fundus of a normal gall-bladder to the beginning of the common duct would be  $4 + 2 = 6$  inches. A continuous incision from the fundus of the dilated gall-bladder in Dr. Marcy's case down to the beginning of the cystic duct would be at least five inches, and to the beginning of the common duct would be two inches more, or at least seven inches. It is evident, consequently, that Dr. Marcy with his four-inch incision divided only the gall-bladder, the stone being lodged firmly in a sacculum in the wall of the gall-bladder, which occurs commonly. His four-inch incision might have reached slightly into the cystic duct, although to accomplish this would have required an incision of five or six inches. It is a physical impossibility that Dr. Marcy's four-inch incision reached the common duct. Before the second publication of

1897 I communicated to him by letter my disbelief in his claim. His persistency, however, in the matter of priority imposes upon me the thankless task of setting the matter right.

CHRISTIAN FENGER.

CHICAGO, ILLINOIS, April 12, 1898.

#### REJOINDER BY DR. MARCY.

I THINK my report as given in 1890 concise and correct. I never for a moment supposed I should be open to the criticism that I do not know the *common duct* from the *gall-bladder*. The wound was a large one, the liver was lifted up, and the surrounding parts were carefully examined by Drs. Clarke and Nelson as well as myself. Neither of us for a moment doubted that the large calculus was lodged in the common duct. We made no measurements, and the report says "about four inches." The method of continuous sero-serous suturing greatly shortens the line of reunion. Reprint, 1890, p. 20. (*Surgical Relief for Biliary Obstruction*, reprint, *Journal of the American Medical Association*, December, 1890.) "A calculus in the gall-bladder alone rarely causes obstruction in the common duct. On this account the surgeon should not content himself in a completion of the operation without ascertaining as far as possible the patency of the canal into the intestine. . . . If, on account of the hardness of the calculus, or the condition of the surrounding parts, it shall be deemed unwise to attempt crushing, the further division of the duct, in order to obtain access to the stone, is advised, as illustrated in Case V, in my series already reported."

Dr. Nelson, unfortunately, is dead, but Dr. A. P. Clarke has recently stated to me that there could be no question as to the location of the calculus. In a letter upon the subject, addressed to me, dated July 3, 1896, after the criticism made by Dr. Fenger, he writes, "The last stone which you removed was in the common duct near the duodenum. I remember another point which you have not mentioned, that when your incision reached the

hepatic duct, the probe easily entered that duct and the bile continued to flow inordinately. It seems to me, further, that a careful reading of your paper would disclose to any surgeon the fact that the chief trouble of the patient, mentioned as Case V, was the existence of a calculus in the common duct. I am glad you have called my attention to the case, as it was to me full of interest, and one that I had mentioned at the time to other medical men."

I make no reference to the second paper, since Dr. Fenger thinks that its explanatory clauses give evidence of special pleading. The paper of 1890 states, "Careful probing revealed the presence of another calculus in the common duct. All effort at dislodgement failed, and as much force as was deemed justifiable was used in the attempt to crush it, but without avail. . . . I then divided the walls of the duct with scissors and everted its edges from over the roughened calculus, which was even then removed with difficulty." The profession is familiar with the really valuable contribution of Dr. Fenger upon the so-called ball-valve action of a calculus in the cystic duct. It is to me very evident that Dr. Fenger would see in the case under discussion a somewhat similar condition of things. At an earlier stage in the history of the patient such pathologic change may have existed, since she had had repeated acute attacks of biliary obstruction. At this time, however, only a few days prior to the operation, complete obstruction ensued. The gall-bladder became enormously distended, showing that the opening from the hepatic duct through the cystic duct into the gall-bladder was patent, and that for some reason the common duct was obstructed. A tightly wedged calculus was with much difficulty removed, and that this was the cause of the obstruction of the common duct is demonstrated by the fact that, after its removal and the closure of the opening, there immediately followed a free flow of bile into the intestinal canal. I quote from p. 8, reprint, 1890: "Free vomiting of a large amount of bile followed the recovery from

ether. Rapid convalescence ensued without incident, and patient remains vigorous and active. This rough, mulberry-looking calculus, grape-size, was the offending member, weighing when dried fifty-nine grains." It was shown to the Section of Surgery and Anatomy in May, 1890.

I would maintain my reputation for modesty, but not for a moment permit it to be mistaken for ignorance, and a history of nearly 2000 abdominal sections, undertaken for a great variety of pathologic conditions, should familiarize me with the various organs and their relationship. The man who assumes to know more of the conditions found in a section, upon reading a report of the same, than three competent surgeons who shared in the operation lays himself open to the charge of being hypercritical.

HENRY O. MARCY.

BOSTON, MASS., June 1, 1898.

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## THE SURGICAL OCCLUSION OF THE CEREBRAL SINUSES.

By ROBERT THOMPSON STRATTON, M.D.,

OF OAKLAND, CAL.,

SURGEON TO THE RECEIVING HOSPITAL.

THE unsatisfactory nature of the references of recent writers upon the surgery of the brain to the technique of operative procedures requiring occlusion of its sinuses, together with the frequency with which that organ is now the subject of operative attack, requires that attention shall be called to the radically different method to be followed in order to secure closure of these rigid venous canals, to those so commonly and successfully observed in the case of veins proper.

The latest work from the American press, dealing quite thoroughly and authoritatively with the subject of cerebral surgery, unqualifiedly asserts with reference to the sinuses that "when necessary to attack them they may be ligated and divided." This statement, together with the declaration, by the same author, that clamps may be used instead of ligatures, without reference in either case to the necessity of adopting any other mode of procedure than would be necessary in dealing with a vein with its easily collapsible walls, is certainly misleading.

Yet the statements of that author give but the same impression which is conveyed by the study of the writings of others who have practised or upheld the use of the ligature. To follow at least their implied method, I shall attempt to show, is to invite defeat and subject the patient to grave danger.

Even when the overlying portion of the calvarium has been successfully removed, the determination of the location of the borders of either the longitudinal or lateral sinuses, to which this paper primarily refers, is difficult or even impossible, unless by suitable incisions in the dura the sense of sight and even touch is allowed a freer range to establish their situation. And without that knowledge to blindly pass the ligature, even if we are not to consider the probable damage to the cerebral tissues which that procedure entails, and are so fortunate as neither to puncture the sinus nor wound a pial vessel, and include within the ligature only the proper amount of the dura beyond either border of the sinus, there still remain two dangers before occlusion can be effected. The *sinus may be lacerated* as the ligature is drawn taut, with the result of having a troublesome or an appalling hæmorrhage, or *pressure upon the cerebral substance may be produced* by increasing the tension of the dura and depressing it below its normal position. The possibility of both of these disadvantages exists by reason of the firmness and inelasticity of the dura mater.

If neither of them is to result, in case relaxation of that membrane does not exist as one of the conditions inducing operation, or has not been effected by the surgeon, as the ligature is drawn tight the dura or falx—or the tentorium, if the lateral sinus is being operated upon—must tear sufficiently and in such a direction as to permit easy and safe approximation of its walls. That they would do so to that extent as to allow no material degree of tension of the dura, or in such a direction as not to involve the walls of the sinus, are chances so small that the risk is entirely too great to be assumed.

Of course, coincidently with the tightening of the ligature the dura could be suitably incised, and thereby cerebral pressure and laceration of the sinus avoided; and even after tying the ligature, incisions of the dura would relieve pressure upon the cortex by that membrane. But the advantages of making the incisions in the dura prior to passing the ligature

are so great that, since that tissue must be incised, it should be done at such a stage of the operation as will permit advantage to be taken of it in the avoidance of the danger of wounding the cortex, sinus, or the veins entering it.

The possibility of puncturing the pial vessels in the passing of the ligature should be especially emphasized. In my

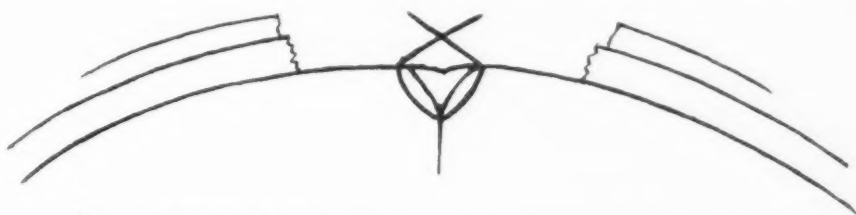


FIG. 1.—Representing the experiment on the cadaver; transverse section of skull, normal size, showing lumen of sinus, normal curve of dura mater; ligature *in situ*, ready for tying.

opinion, it amounts to a degree of danger so great as to forbid its performance without visual guidance. At their juncture with the sinus most of these veins are of considerable size, and in some of the pathologic conditions requiring operation may be much larger and more tortuous than they normally are, and their walls being extremely delicate make them



FIG. 2.—Showing modification of normal curve and depression of the dura mater, resulting from occlusion of sinus by ligature.

easily susceptible to laceration. Nothing less than the cautious incision of the dura—except in children in whom this membrane is translucent—and the accurate placing of the ligature by the sense of sight will guarantee against a troublesome hæmorrhage from this source. It would be possible for even a fatal subdural extravasation of blood to gradually take place without the operator's knowledge unless the dura were incised to permit its discovery and prevention.

The following experiment upon the cadaver is of interest in this connection, and demonstrates the fact, already stated, that even if closure of the sinus be effected without laceration of its walls, an unjustifiable amount of pressure upon the cortex will result from the improper use of the ligature.

An opening one and three-fourths of an inch in its antero-posterior diameter was made through the vertex of the skull of an adult, in the median line, without laceration of the dura mater. Two ligatures were passed around the longitudinal sinus one-half inch apart, and about equidistant from a point one and one-fourth inches posterior to the midpoint between theinion and glabella, and embracing within their grasp about seven-sixteenths of an inch of the dura over and adjacent to the sinus. After the ligatures were drawn tight enough to occlude the sinus and tied, the sinus was cut transversely between the ligatures, and the incision was extended well outward on both sides.

No laceration of the sinus and only a slight tear of the dura resulted. The latter was, however, locally in a state of marked tension, the normal curve was decidedly modified, and it was detached from and depressed beneath the inner surface of the skull for a considerable distance beyond either lateral border of the bone opening. At a point where the aperture in the skull was one and one-half inches wide the dura was estimated to be depressed three-sixteenths of an inch beneath one border and one-eighth of an inch beneath the other.

By reason of the increased degree of intracerebral pressure during life over that which exists *post-mortem*, there would be much greater liability of lacerating the sinus if the same operation were performed upon the living subject.

As far as relates to the control of hæmorrhage, the ligature has been used with success a number of times. Ashhurst, in 1885, in referring to wounds of the sinuses, states that "ligation has been occasionally practised." Kammerer, in 1889, ligated the longitudinal sinus an inch or so above the torcular Herophili as a preliminary to the removal of a sarcoma involving the dura above the sinus. Park mentions ligation and even resection as legitimate procedures. Starr

refers approvingly to tamponment, forceps-pressure, and suture of the sinus in case of hæmorrhage, and in the same condition Keen states that "the sinus has been tied by two ligatures." But none of these writers, however, call attention to the unwarrantable degree of cortical pressure which the use of the ligature or clamp may entail. If it was appreciated, or any precautions were taken to prevent such pressure, no mention was made of it by them nor by other surgeons, so far as a necessarily partial search in the literature of cerebral surgery enables me to declare. I have not had the opportunity of referring to the writings of Heinicke, Navratil, von Bergmann, and Küster, or others, who have performed ligation, but the references to their reports which I have seen do not convey the idea that it was recognized by them that such an unfavorable condition might accompany that procedure.

Nor has the danger of laceration of the sinus during the tightening of the ligature apparently been sufficiently realized or emphasized. Macewen, however, in order to avoid that accident, recommends a method practically the same as that mentioned by Ashhurst, of securing occlusion by separating the outer wall of the sinus from the skull, and pressing it inward into the lumen of the sinus, and tamponing the intervening space. This seems to be a method especially adapted to the rapid relief of hæmorrhage—and it is in this connection mentioned by Ashhurst—rather than a procedure to entirely prevent it, and to be generally commended in deliberate surgical attack upon a sinus.

It can be advanced as a proper objection to this method of securing occlusion in formal resection that the general impossibility of knowing prior to the time of operation the necessity of the destruction of the sinus or of estimating the extent to be excised, should that be found necessary, the borders of the bone opening will seldom be so located that this procedure could be adopted without sacrificing a greater extent of the sinus than would be required by a method permitting greater freedom of choice in locating the site of oc-

clusion. In its bearing upon the subsequent establishment of the anastomotic circulation this is a matter of much importance.

The greater sense of security which other methods give will also, I believe, cause this procedure to be followed in a comparatively small proportion of cases, other than for the relief of accidental hæmorrhage.

The application of the clamp presumes almost necessarily the exposure of the sinus, and in effecting this it would generally happen that sufficient relaxation of the walls of the sinus to permit their easy approximation had been effected. If, however, this has not been provided for, danger of laceration of the sinus or brain-pressure would exist, as in the case of the use of ligature. The degree of the liability to bleeding is less, however, with the clamp by reason of the greater width which it possesses with consequently less likelihood existing of its tearing or cutting its way directly into the sinus as the ligature might do.

Providing the preliminary work of the surgeon has not caused sufficient relaxation of the dura or it does not exist as the result of traumatism, formal incisions along at least two of the borders of the sinus are necessary to prevent the danger of hæmorrhage or pressure; and while choice can be made of any two, those generally the most accessible and therefore the most easily and safely incised are the two superficial borders. However, it may possibly happen that the conditions of the operation will make the deep border sufficiently accessible to permit incision in that locality. Especially is this to be preferred in cases where it is unnecessary to remove both lateral walls of the sinus. By making incisions along the deep and one lateral border a tumor involving only the wall on that side might, after effecting occlusion of the sinus, be removed by exsecting only the wall involved. If the small incision in the dura on the side opposite the growth, made to allow the safe application of the ligature by inspection, is accurately sutured before the ligature is tied,

the dura on that side would be left intact. A decided advantage would thereby be gained.

Due consideration must be given to the important functions of the supporting membranes of the brain, and no incisions should be made of greater length than are absolutely necessary to accomplish the end sought. Long incisions are unjustifiable. Thus, if the falx, or tentorium, or even the dura in the neighborhood of either of these, is extensively incised, the proper relation which one portion of the brain should permanently bear to the other is destroyed. With change of position of the head the weight of one hemisphere would have to be sustained, in part at least, by the other, or the cerebellum would be unduly pressed upon, according to the site of the incisions. A small disturbance of the cerebral support and equilibrium would be associated with disturbances either troublesome or grave according to the amount of disability existing in these membranes.

The advantage which properly constructed clamps<sup>1</sup> possess over ligatures lies principally in the relative ease and speed with which they can be applied. Thus far their use has not been attended with hæmorrhage upon removal, a fact to be accounted for by reason of the low degree of blood-pressure in the sinuses. However, experience in their use has not as yet been so abundant as to disprove this to be a real danger, and if the patient's condition is such as to permit the cautious application of ligatures, their use is to be preferred.

If clamps are used, they are incorporated with the wound coverings and removed with the first change of dressings at the expiration of from one to three days. Nor do they by requiring an open wound interfere with union. As is well known, even when these wounds pursue an aseptic course, the free discharge of bloody serum requires drainage for several days at least, and the openings left for the clamps can be utilized for that purpose.

<sup>1</sup> They should be of light weight, have short handles, be made of non-corrodible material and, for reasons which will appear later, be constructed so as to permit of their gradual closure.



Wherever the cortex is left unprotected by its supporting membranes, the usual precautions are to be taken to prevent the formation of adhesions.

The description of the *technique* observed in the following operation, in which one and one-fourth inches of the longitudinal sinus were excised for fibrosarcoma, involving the sinus as well as the dura and falx adjacent, will serve to illustrate more plainly the method proposed, as well as to show the difficulties which may attend such an operation.

The tumor had been located by the sense of touch at an operation for the relief of adhesions between the cortex and dura arising subsequent to an earlier operation for a lesion of the leg-centre of the left hemisphere.

The original symptoms were those of Jacksonian epilepsy, beginning early in 1894, and involving first the right leg and arm and later the thigh and shoulder muscles, and then the right side of the neck and face. Only once did a general convulsion accompanied with unconsciousness occur. Later paresis of the extremities mentioned developed. Sensory disturbances were also noted. The order of the symptoms indicated the leg-centre as the point of origin, and an operation, performed March 15, 1897, resulted in the removal of a large fibrosarcoma arising from the falx cerebri on the left side opposite the leg-centre.

Complete relief of the Jacksonian attacks followed the operation until May 14, although the paresis was not entirely cured. Convulsive attacks similar to the original, but involving only the muscles of the arm, neck, and face, previously affected, then supervened. The absence of symptoms of irritation of the leg-centre, as well as of dilatation of the retinal veins and other pressure symptoms, made me consider the trouble to be due to adhesions, and an operation, on December 7, proved the correctness of that conclusion. I took the opportunity afforded by this operation to determine if there was any return of the original tumor. It was then that the recurrent growth already referred to was discovered.

It was still too small to create disturbance, but if the patient was to be given the chances of relief which an operation could offer, the tumor must be excised before a greater extent of the falx should become infiltrated with the neoplasm. Accordingly,



as soon thereafter as the patient's condition warranted, the operation to be described was performed. In it I was assisted by Drs. William S. Porter, Charles M. Fisher, and Carl R. Krone, the work being done at the East Bay Sanatorium of this city, on February 2, 1898.

The new growth was situated on the left side, at a point on the superior longitudinal sinus, somewhat posterior to the mid-point between the inion and glabella. Allowing for the increase of size between the date of its location and operation, it was estimated to be about one inch long in its antero-posterior diameter and to extend five-eighths of an inch to the left of the median line, its shape being elliptical. In depth the tumor was regarded as extending beyond the walls of the sinus down a short distance on the falx proper.

An omega-shaped incision of suitable dimensions having been made in the scalp, and considerable hæmorrhage having been controlled, with the Devilbliss trephine and skull-forceps, an incomplete, elliptical opening, somewhat smaller than the scalp-flap, was made in the calvarium over the tumor. Coincidentally much blood welled up from the vessels of the diploe and dura mater, the latter being lacerated where they leave that membrane to enter the skull along the sagittal suture. The amount of this hæmorrhage even suggested the possibility of the sinus having been torn. Adhesions of the dura to the skull and the presence of vessels of new formation, the result of inflammatory changes over and adjacent to the tumor and as a result of the previous operation, increased materially the difficulties and amount of bleeding at this stage of the operation. The inequalities in the thickness of the parietal bones from the same causes impeded the rapid progress of the bone incision by rendering extra caution in the use of the forceps necessary lest the dura or sinus be lacerated. The close adhesion to the skull and the dura overlying the sinus, and especially over the tumor, made elevation of the bone-flap and fracture across its base a matter of much difficulty. However, by gradually elevating it by prying it outward simultaneously at two distant points and at the same time cautiously separating the adhesions by introducing the end of curved blunt scissors, raising of the bone-flap and its attached scalp was effected without laceration of sinus or dura.

Although an osteoplastic resection had been planned, the

appearance of the inferior surface of the bone-flap suggested the probability of it having been invaded by the neoplasm, consequently it was removed. The tumor having increased in size much more than had been expected in the interval subsequent to its location, it was found requisite to further enlarge the opening.

The dura was incised around the tumor and along the borders of the sinus on both sides the full length of the bone opening. This, however, was only accomplished by again meeting at almost every point with free hæmorrhage. This was best controlled by tampons and by making the dural incisions from several points rather than by one long continuous cut on each side, and the intermittent application of compresses, gradually incision of the entire extent contemplated was accomplished. The danger of wounding the veins of the pia near to their point of entrance to the sinus necessitated slow and cautious work; nevertheless, one large, tortuous vein entering the sinus opposite the tumor was punctured and required ligation. Its occlusion was, however, necessary to exsection of the sinus.

Clamps with lock-handles, with blades at right angles to the former, were now applied to the sinus beyond each extremity of the tumor, but not so near the limit of the incisions in the dura along each border of the sinus as to interfere with easy approximation of its walls when the clamps were closed. Adhesions between the pia and falx, on both sides, were separated with the handle of a scalpel, and the sinus was incised beyond the tumor and close to each clamp. The falx was incised beneath the tumor with blunt scissors curved on the flat and tumor, sinus and adjacent dura were removed entire without hæmorrhage.

Thin gold leaf was laid between the hemispheres when the sinus had been removed and over the portions of the hemispheres deprived of the dura.

Provision not having been made for a heteroplastic operation in the skull, the scalp-flap was sutured in place reluctantly, leaving the insertion of an aluminum or other plate for some future occasion, should it be found necessary. Openings were left to permit free drainage by gauze wicks inserted in such a manner as not to disturb the gold leaf on their withdrawal.

The clamps were left *in situ*, their handles being directed forward and backward respectively. The usual dressings were

applied to the site of operation, provision being made for the absorption of a probable large sero-sanguinolent discharge. Over all a plaster-of-Paris dressing was applied, thus protecting the wound, and at the same time firmly holding the clamps in place.

The accompanying cut well represents the inferior surfaces of the tumor, sinus, and adjacent dura. The incised border of the falx is also easily discernible. Figs. 3 and 4 are of the actual size of the specimens.

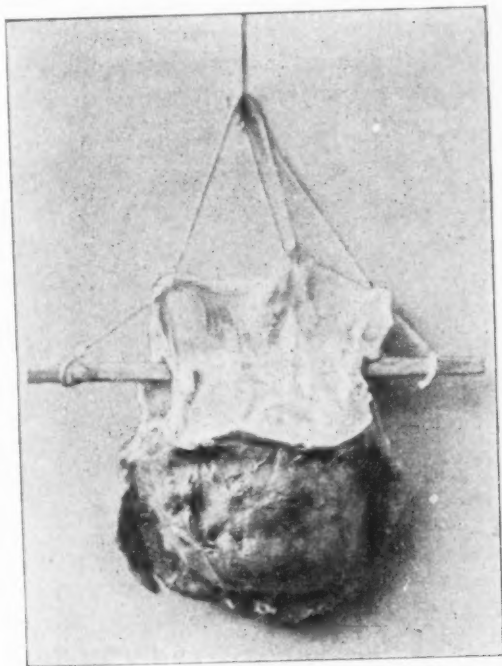


FIG. 3.—Sarcoma of dura mater, with excised portion of longitudinal sinus.

Measurements showed the length of the excised portion of the sinus to be one and one-fourth inches; the longest antero-posterior diameter of the tumor the same; the transverse diameter one-eighth of an inch less; depth, three-fourths of an inch. The entire specimen weighed 173 grains.

The lumen of the sinus was nearly occluded by the new growth, the ordinary wooden toothpick could just be made to pass through the sinus without force being used. By reflecting

a flap of the sinus wall the lumen of the unoccluded part of the canal is well demonstrated in the cut.

Fig. 4 represents the inferior surface of the skull section removed. The foramina for the vessels entering the skull from the dura along the sagittal suture are well shown, and account for the free hæmorrhage during the early part of the operation. The dark area in the lower part of the figure represents the attachment of the tumor. This part of the bone was rough, porous, thickened, and stained a brownish red. The lower curved border shows the limit of bone section at a previous operation.

The patient's symptoms subsequent to operation as well as the appearance of the wound indicated an aseptic course. Vomiting continued *fifty-six hours*. At the expiration of the third

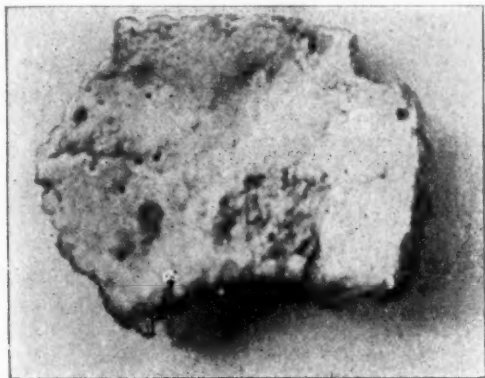


FIG. 4.—Under surface of calvarium removed.

day the clamps were removed without hæmorrhage ensuing. There was marked adynamia from the first. After the fifth day this gradually became more profound, death occurring February 14, a period of twelve days, lacking about five hours, having elapsed since the operation was performed.

The autopsy revealed an entire absence of pus. There was thrombosis of the superior longitudinal sinus from the location of the anterior clamp for a distance of one inch forward and from the site of the posterior clamp to the torcular Herophili. Two enlarged veins entering the sinus on either side at about the location of the posterior clamp were filled with a firm clot for a distance outward of about three inches from the sinus. A thrombus extended the entire length of the straight sinus. There was

a protrusion of the cortex of the right hemisphere at the site of the operation, above the level of the skull, causing bulging of the scalp. This area was inflamed, partly softened, and disorganized. About one-fourth of an inch beneath the surface was a clot approximating one-half fluid ounce in volume, in the ascending and superior parietal convolutions, surrounded by a narrow zone of softening and œdema. The origin of the hæmorrhage could not be discovered. There was œdema of approximately the lower half of the brain; the base including the fourth ventricle was markedly anæmic.

With a view of devising, if possible, a mode of procedure which might in similar cases lead to a successful termination, let us inquire especially into the causes of the failure of the establishment of the collateral circulation.

Among these factors I would note:

(1) The *sudden* stopping of the flow of blood through the sinus and the large vein entering it opposite the tumor. Inasmuch as the lumen of the sinus was already largely occluded by the neoplasm, the collateral circulation had been nearly established, and largely through this vein. Before anastomotic channels could become large enough to permit sufficient flow of blood, clotting probably took place in the distal portion of the sinus.

(2) The low degree of blood-pressure in the cerebral vessels resulting from the excessive hæmorrhage during the performance of the operation.

(3) The shock from the operation and the prolonged administration of the anæsthetic producing feeble cardiac action and dilatation of the peripheral vessels with consequently further reduction of blood-pressure and increase of tendency to blood stasis.

The impression seems to prevail that a permanent disturbance of the circulation as the result of the occlusion of a cerebral sinus is not a result to be greatly feared. Evidently the experience of Kammerer, in whose case there was such a result and a fatal termination, has been overlooked.

But the revelations of the necropsy in my own case, together with his experience, should forcibly impress the fact that the occlusion of a large cerebral sinus is not a matter to be lightly undertaken, and only with every precaution to maintain the continuous and forcible flow of blood through the unoccluded portions of the sinus and its anastomosing veins.

It emphasizes also the value of suturing wounds of the sinuses, when practicable, in order to stop a hæmorrhage in preference to methods involving occlusion, and thereby avoid the dangers which might follow the latter procedure in the condition of shock, which generally accompanies cerebral traumatism.

To prevent the failure of the establishment of the collateral circulation, I would strongly urge that the following precautions be taken in deliberate operations for lesions, the symptoms of which suggest the possibility of requiring destruction of a cerebral sinus:

(1) Prevent excessive loss of blood by the application of the tourniquet *firmly* to the scalp and prompt occlusion of bleeding points on its removal; also by rapid bone-section and tamponment of the resulting sulcus. Starr states that the method of preventing hæmorrhage by the application of the tourniquet to the scalp is a failure, but my own experience has taught me its great value at least in certain cases. If much oozing of blood occurs upon incising the dura, rapidly complete the necessary incisions by the assistance of a delicately grooved director and apply tampons. Avoid puncturing the pial vessels.

(2) The bone- and scalp-flaps having been raised and hæmorrhage stopped, conclude the operation at this stage according to the method advised by Park in operations on the brain in which there is danger of shock, by inserting between the edges of the scalp a layer of gauze to which an antiseptic ointment has been applied. In a week or two, when the effects of this stage of the operation have passed off, conclude the second stage.

If, however, the circulation of the patient lacks vigor,

or if for any reason there is doubt as to the second stage being concluded without shock, in addition to the above make dural incisions necessary to permit the proper application of ligatures or clamps, apply these and partly close the lumen of the sinus with a view of performing *gradual occlusion*. This is to be effected by partially tightening the ligatures or closing the clamps about every second day, until, in the course of one or two weeks, the sinus is entirely occluded, and thus, by the time the patient's condition warrants the concluding part of the operation being performed, the collateral circulation will have been already established and the possibility of blood stasis and thrombosis reduced to a minimum.

The same circulatory conditions which would cause the method of gradual occlusion to be adopted as a part of the preliminary stage should induce its being followed in the secondary operation, should shock supervene at any time during its performance or should pial veins, taking an important part in the anastomotic circulation, be accidentally injured or destroyed by the necessities of the operation.

This would cause the concluding steps of the operation to be still further delayed, but, however undesirable and although attended with increased risks of sepsis, is, in my opinion, under the circumstance named to be strongly commended.

(3) During the performance of the final stage of the operation and after occlusion of the sinus, should extensive hæmorrhage occur or should there be any tendency for the pulse to become soft, small, or feeble, maintain a proper degree of blood-pressure by having an assistant perform at once intravenous saline transfusion,—a vein having been previously exposed, should the necessity of this seem at all probable. Or Esmarch's bandages may be applied to the extremities or the two procedures may be conjoined.

Further than this, prevent any tendency to shock by proper stimulation with alcohol, strychnine, etc., by operating rapidly and having all contingencies provided for and



allowing only the least possible amount of the anæsthetic to be administered.

(4) Avoid especially injury to the veins of the pia mater, through which the blood-current is to be maintained after occlusion of the sinus is effected. This includes not only laceration or puncture, which would require ligation, but also all those procedures which tend to maintain the vitality of the parts locally and prevent hernia cerebri. Among these factors can be mentioned rigid aseptic technique, the avoidance of traumatism and osteo- or heteroplastic operation on the skull. It can be readily seen that even a slight protrusion of the cortex beyond the level of the internal surface of the skull would occlude the lumen of any vein traversing its surface by compressing it against the border of the bone opening. Also the long-continued vomiting, as occurred in the case narrated, and possibly even the cerebral pulsation which results from removal of the firm bony support to the brain, will, if the dura has been extensively incised, produce such a degree of traumatism of the delicate cortical substance as to induce not only a local cerebritis, but even softening and disorganization. A vein traversing such an area would be destroyed, even if hernia cerebri did not cause its occlusion.

(5) During and after the operation have the posture of the patient such as will maintain a proper degree of pressure within the cerebral blood-vessels and facilitate the flow of blood through the sinus and the vessels concerned in the anastomotic circulation. The head should be on a level with the body and the face directed upward.

(6) If vomiting continues for any considerable period subsequent to the operation, administer salt solution *per rectum*, and thus assist in maintaining the fluidity and proper degree of pressure of the blood.



## HYSTERIA FROM A SURGICAL STAND-POINT.<sup>1</sup>

By JAMES E. MOORE, M.D.,

OF MINNEAPOLIS,

PROFESSOR OF CLINICAL SURGERY IN THE UNIVERSITY OF MINNESOTA.

HYSTERIA is usually considered to be strictly within the province of the neurologist or the general practitioner, but surgeons meet with it in many forms, and, should they fail to recognize it, will frequently be guilty of grave errors in diagnosis and prognosis.

Hysterical symptoms frequently appear as a post-operative complication, and when unrecognized may lead to unnecessary anxiety. A rise of temperature is not a part of the clinical history of hysteria, but we may have a post-operative rise of temperature in an hysterical patient, which cannot be accounted for in any other way than by calling it a neurotic temperature. I recently performed a curettement upon an hysterical patient who developed mild delirium and a temperature of 102.8° F. on the second day. She reminded me that some three years previously, when I had performed a trivial operation upon her, she had had fever which had been relieved by injecting medicine into her arm. I ordered the nurse to administer an eighth of a grain of morphine hypodermically, and in two hours her temperature had disappeared. We have doubtless all been worried over a temperature of this character following a laparotomy.

Persistent hiccough after the administration of an anæsthetic is sometimes purely hysterical. I remember one instance in which this symptom was so persistent that I began to fear for my patient's life, when I ascertained that

<sup>1</sup> Read before the American Surgical Association, April 27, 1898.

her father had hiccoughed for three days before he died, and that she had always feared that she might die the same way. She was given the positive assurance that her condition was so entirely different from her father's that she could not possibly die in that manner, and an enema containing assafoetida was administered, which gave prompt relief.

Persistent cough or emesis following an operation may be purely hysterical.

I once operated upon a splendid specimen of physical manhood who suffered from aphonia for some days afterwards, which I was at a loss to explain, until I learned that he had suffered from a similar attack immediately after some business reverses. Every laparotomist should be on guard against phantom tumors.

When a neurotic female presents herself for surgical treatment, and the subjective symptoms are out of all proportion to the objective, we should be upon our guard, for operations under these circumstances are seldom of more than temporary benefit. These patients frequently derive a morbid pleasure from operations, and are perfectly willing to submit to the most dangerous surgical proceedings, when, by careful observation, the surgeon may satisfy himself that their sufferings are purely imaginary. Such patients should go to the Osteopaths or Christian Scientists, and add to their list of marvellous cures rather than fall into the hands of unscrupulous, would-be surgeons.

I recently saw a woman who had had her "rectal pockets" slit up and her ovaries removed, and who had called me, expecting to submit to an operation for appendicitis. Her abdomen was rigid all over, and she complained of exquisite tenderness upon pressure over the right inguinal region, but her temperature and pulse were normal. She had all the symptoms of hysteria minor, and seemed quite disappointed when informed that she did not have appendicitis and did not need an operation.

Hysterical hyperæsthesia, anæsthesia, paresis, or seemingly complete paralysis may be so mingled with real patho-

logic conditions as to mislead the most skilful diagnostician. I have found Patrick's suggestion with reference to the rapid shifting of the border of the affected area in hysterical hyperæsthesia or anæsthesia a very valuable aid in diagnosis. (Gould's "Year Book," 1897, p. 805). If the hyperæsthetic area be outlined and lightly marked, and another examination be made a few minutes later, the outline will have changed.

It is in joint and spine ailments that the surgeon is most likely to meet with hysteria, and it is of so frequent occurrence here, and oftentimes so closely resembles real disease, that he must ever be on his guard lest he mistake the shadow for the substance. Sometimes the hysterical joint-affections so closely resemble tubercular joints as to deceive very good diagnosticians, but ordinarily one needs but to know that there is such a malady as an hysterical joint to be able to recognize it.

The hysterical joint usually, but not always, follows an injury. There may be slight atrophy, but it will only be such as is due to non-use or bandaging of the limb, and should not be mistaken for the marked atrophy accompanying tuberculosis. In hysteria there is no local rise of temperature, but it may be subnormal. There is no marked swelling, although there may be slight puffiness about the joint. There is marked restriction of motion in hysteria, but it differs very materially from that so characteristic of tuberculosis. It varies from one minute to another, and may temporarily disappear when the patient's attention is directed to something else. The muscular spasm is very different from that of tuberculosis. It is more marked, and is voluntary in character.

An hysterical joint is usually deformed. The deformity is apt to be a flexion, more marked than in real disease. In some joints, for example the hip, the deformity may be greatly exaggerated and different from what would be expected from disease.

In making a diagnosis the age and sex are to be borne

in mind, hysteria being more common in young women, although it may develop at any age and in either sex. When convulsions or other hysterical symptoms are present they may be helpful to the diagnostician, but it is quite possible for an hysterical person to have a tubercular joint. I have one case of hip-joint disease under treatment at the present time, in which the hysterical symptoms cause the friends more anxiety and me more trouble than does the tuberculosis.

An hysterical joint occurs, as a rule, in an hysterical patient. The pain is not that of an inflamed joint, but is an hyperæsthesia. The deformity may resemble very closely that of tuberculosis, but there is a difference. The symptoms are all exaggerated, and the whole condition gives the experienced examiner the impression that the patient is playing a part.

The prognosis is good, for while some cases are very persistent, they eventually recover. It is said that a hysterical contraction may become permanent, owing to organic changes brought about by the prolonged abnormal position, but such a condition has never come under my observation. Were it not that some very able observers have reported this condition, I should think that an error in diagnosis had been made, for in numerous instances, where a joint had been flexed for a long time, I have seen such speedy relief as to preclude all possibility of the presence of any organic change. The miracles performed by various pretenders are doubtless of this character.

Hysterical patients, fortunately, are very susceptible to suggestion, and what one does for them is not so important as it is to insist that whatever is done will cure them. I have obtained the best results from administering an anæsthetic, reducing the deformity, or rather, allowing it to reduce itself, holding the limb in proper position for a short time, and insisting that a cure had been wrought, and that the patient is able to walk. Very little of the anæsthetic is necessary, as they yield to it very quickly.

It is questionable if a cutting operation is ever necessary for the relief of an hysterical deformity. Tenotomy is a very safe procedure, and it may be justifiable in an extreme case. I believe, however, that the operation helps through suggestion rather than by relieving contracture. Cases reported in which organic changes are said to have taken place in the spinal cord following hysterical contractions should not be classed as hysterical cases, as they are evidently cases of organic disease, and if hysteria be present at all, it is merely a coincidence.

It is comparatively easy to make a diagnosis of an hysterical spine, because the deformity does not resemble that of disease, and the patient complains of extreme pain and sensitiveness at the seat of deformity, which does not obtain in real disease.

Since comparatively little has been written upon this interesting topic, I will give briefly the history of a few selected cases, illustrating hysteria as met with by the surgeon.

CASE I.—A young woman from North Dakota, referred to me by Dr. Hall, of Minneapolis. She was eighteen years old, fair-haired, blue-eyed, red-cheeked, well-developed, and healthy-looking. She gave a history of having had a fall some months before, injuring her hip, from which she had been lame ever since. Upon examination I found the right hip flexed and adducted to a marked degree, just as one would expect to find it in a dislocation upon the dorsum. Upon manipulation, a distinct slipping, as of the head of the femur upon the dorsum of the ilium, could be felt and heard. The temperature was  $100^{\circ}$  F., and the patient complained of great sensitiveness of the joint. There was slight atrophy of the affected limb. The thigh could not be abducted or extended to the normal limit, and the patient complained bitterly of efforts in that direction. She had been to a local osteopath, who had pulled her leg both literally and metaphorically.

My diagnosis at this time, based upon the history as I understood it, and upon the temperature, atrophy, and deformity, was traumatic subluxation of the hip, with a subacute synovitis,

due to the violent manipulation of the quack. Owing to the large amount of adipose about the patient's hips it was impossible to decide whether the trochanter was above Nélaton's line or not. I applied a long extension splint, which seemed to hold the limb in proper position and to relieve pain. After a couple of weeks the temperature had disappeared, and the patient seemed to be doing so well that I allowed her to go to her Dakota home, wearing the splint. For three months reports from the family and physicians were very favorable. At the end of four months came the report that she was very much worse; that the brace no longer prevented the hip from slipping, and that the knee was flexed and rigid. The family physician reported that she had hysterical convulsions. My suspicions were at once aroused, and I advised the patient to come to Minneapolis, to the Northwestern Hospital, immediately, which she did.

I found the hip the same as when I had first examined her, save that there was less tenderness and no rise of temperature. The knee was flexed to a right angle and perfectly rigid. It was perfectly normal in appearance and without local heat, although the patient complained of great tenderness in it. I at once made a diagnosis of an hysterical knee, with a strong suspicion that the whole trouble was hysterical. I announced to the hospital internes my intention of performing a miracle, and ordered them to chloroform the patient. As soon as a few whiffs of the anæsthetic were taken, the contracted muscles began to relax, and the limb fell into its normal position, with nothing but its own weight to aid it. Both joints were normal. A plaster cast was applied from the toes to the umbilicus, and the patient was assured, upon regaining consciousness, that she had been cured. At the end of a week the case was removed and the patient told to walk, which she did, and she has been able to walk ever since.

What deceived me at first was the rise of temperature and decided slipping of the joint, together with the understanding I had that she had been unable to walk since the accident. I have since learned that she had walked for some time after the accident. This patient shortly afterwards developed a curvature of the spine, which differed in appearance from any curvature due to disease, which improved

very rapidly under very strong—and consequently painful—shocks from a static machine. This patient can cause a click in that hip at will, which can be heard and felt. I have placed my hand upon the trochanter, with the patient standing, and tried to make out just what happened. She throws her weight upon the limb and suddenly rotates the femur forward, causing the tendons of the glutæus minimus, pyriiformis, and obturator internus to slip over the top of the trochanter with a snap. Dr. Shaffer, in his paper on "The Hysterical Element in Orthopædic Surgery," has given a very satisfactory explanation of the knee-click, but I have never heard the hip-click explained, and offer the above explanation, which, after careful study, I believe to be correct. The temperature she had when I first saw her was probably due to an inflammation of the bursæ under these tendons.

The prompt relief afforded by treatment in this case is, of course, conclusive evidence of the correctness of my diagnosis.

Another characteristic point is the small amount of anæsthetic required to relax the spasm, for while it is possible to relax the spasm due to tuberculosis, it requires profound anæsthesia.

CASE II.—In May, 1897, I was called by Dr. J. T. Moore, of Minneapolis, to see a young woman from the southern part of the State, who claimed to be a great sufferer, and who had come to the city to have an abdominal tumor removed. About two years ago she was examined by a local physician, who told her that she had a tumor in her abdomen, which he proposed to remove. She came to Minneapolis at that time and was examined by Dr. Moore, who told her that he could find no tumor, and advised her to go home. Since that time she has written several times to the doctor, telling him of her great suffering. Once within that time her home physician has written, stating that the tumor was growing quite rapidly, and that he feared it would soon become inoperable.

In appearance the patient was as healthy a nineteen-year-old girl as you could find in a day's journey. In trying to get a his-

tory, about all I could elicit was that two years ago she had been told that she had an abdominal tumor, and that she had been a great sufferer ever since.

Upon examination we found the pelvic organs perfectly normal. When we undertook to palpate the abdomen she complained of the great pain it caused her. After a little, however, her rigid abdomen relaxed, and we could feel a large solid mass just below the umbilicus, which we soon found to be the spinal column. We then found that there was marked lordosis, and that the lumbar spine was several inches from the table when she laid upon her back. We then had her stripped, when she showed the characteristic gait and deformity of a double congenital dislocation of the hip. Both trochanters were fully two inches above Nélaton's line, and the lumbar spine was so arched forward that it could readily be felt through the abdominal wall. This girl has a decided tumor in her abdomen, but one that causes no pain, and one that few would care to operate upon. Her pain is clearly in her mind, and she probably would never have had it had she not been told that she had a tumor, for that same tumor had been there for seventeen years without causing her the least pain. She was not at all pleased with our diagnosis and prognosis, and was decidedly disappointed when we sent her home without an operation.

CASE III.—I was recently called by Dr. Emily Fifield, of Minneapolis, to see a patient, about fifty years old, who stated that she had been a great sufferer all her life, and that for many years her uterus had been paining her so much that she had finally made up her mind to have it removed. She stated that she had had her cervix "fixed up" some time before by a Boston physician, but without benefit. She was very emphatic in her statement that she would not submit to anything short of a vaginal hysterectomy. She was so exquisitely sensitive that a satisfactory examination could not be made. We finally persuaded her, however, that she did not need so grave an operation as an hysterectomy to relieve her suffering, and gained her consent to do what we might deem advisable after examination under an anæsthetic. She was sent to the Northwestern Hospital, where an anæsthetic was administered, and upon examination we found that she had no uterus. The enterprising Boston gynecologist who had "fixed her cervix" had evidently removed



that organ without saying anything to the patient about it. Her vagina was packed with iodoform gauze, and she was assured, upon regaining consciousness, that her uterus would cause her no more pain.

CASE IV.—Last month I was called by Dr. P. M. Holl, of Minneapolis, to see a patient of his, who had met with an accident to her knee some months before, and had been unable to walk since. At the time of the accident, the doctor stated, he found a small wound over the patella, caused by the point of a nail. He dressed it properly and obtained prompt union, but the patient complained of great suffering. When I was called, the doctor stated that he could see nothing wrong with the knee, but that his patient was very nervous and complained of pain. Upon examination I found the whole limb slightly atrophied. There was no swelling, but when I made pressure upon any part of the knee the patient complained of pain. When she was busily engaged in conversation, however, she did not notice pressure. She would not bend the knee, or allow it to be bent, but I had no difficulty in bending it when her mind was upon something else. This was an hysterical joint, pure and simple. The atrophy was due to the bandaging of the limb.

The patient was ordered to apply a domestic remedy that had been strongly recommended by her mother, and was directed to begin to walk after a certain number of days. We stated very positively that she would be able to walk quite well in three weeks. In four weeks she was perfectly well.

It is well to remember that it is not safe to make the time allotted for recovery too short in a case of this kind, lest our prediction may not come true, and the power of our suggestions be greatly diminished.

CASE V.—The patient, a female, nineteen years of age, came to the Northwestern Hospital from the southern part of the State. She had been confined to bed for about three months by severe pain in her back and hips. Upon examination I found exaggerated reflexes and great sensitiveness in both lower limbs. There seemed to be restriction of motion in both hips, but not of the kind met with in hip-joint disease. She stated that her limbs had grown very much smaller during her illness. She said she could not walk on account of the slipping of her hip-joints. When asked to stand, she could only do so when supported by

two nurses. By placing the hands over the trochanters a peculiar slipping could be felt in both hips, and her joints looked as if they were dislocated, but the trochanters did not rise above Nélaton's line. The restriction of motion and deformity did not resemble very closely any disease or deformity with which I am familiar. I had my suspicions, but, for fear of making a mistake, I requested Dr. Jones, a neurologist, to examine her, to exclude, if possible, a spinal cord lesion. Dr. Jones pronounced the case one of hysteria, and she was treated accordingly, and in a few weeks went home perfectly well. The slipping in this case was exactly like that in Case I, and was undoubtedly caused in the same manner. The slipping and snapping of those joints and the position the patient assumed when required to stand excited the sympathy of all the nurses, and had already deceived a number of competent medical men.

CASE VI.—Quite recently Dr. Ames, of Minneapolis, referred a maiden lady of uncertain age to me for an examination and opinion. She stated that there was something alive in her abdomen; that she wanted it cut out; that, after eating a meal, she could feel "him" crawl up from the lower part of the abdomen to her stomach, and, after eating what he wanted, he would return. Upon a careful examination I found a floating kidney and hæmorrhoids, and advised her that, if these were properly cared for, her dyspepsia would probably be cured. The last report from this case was that "he" was making regular trips up and down her abdomen at least three times a day, and that she believed that her only salvation was in a laparotomy.

# GUNSHOT INJURIES OF THE SPINE, WITH REPORT OF A CASE.<sup>1</sup>

BY THEODORE F. PREWITT, M.D.,

OF ST. LOUIS,

PROFESSOR OF THE PRINCIPLES AND PRACTICE OF SURGERY AND CLINICAL SURGERY  
IN THE MISSOURI MEDICAL COLLEGE; SURGEON TO ST. JOHN'S HOSPITAL.

IN 1891, Dr. J. William White read before the American Surgical Association an able and exhaustive article upon the "Surgery of the Spine,"<sup>1</sup> in which he discussed fractures and their treatment, refuting the objections urged by various authorities to all operative interference, and sought to show that the results of operative treatment, in properly selected cases, of fracture of the spine are encouraging, and should lead to the more frequent employment of resection of the posterior arches and laminæ. He made no distinctive reference to gunshot injuries and the special features they present.

In 1893 I met with the following case:

Howard Diggs, aged fourteen years, of Glasgow, Missouri, while out on a picnic, Tuesday, May 15, 1893, received a shot in the back of the neck from a small target gun (No. 22) in the hands of a young lady of fifteen years, who stood immediately behind him, the muzzle being within two and a half inches from his neck. He was on a railroad bridge, sitting on one tie and whittling on another. The gun was supposed to be not loaded, had been snapped before several times, perhaps, but, with the usual fatality, when the victim was in line went off when the trigger was pulled.

The boy fell and was found completely paralyzed on both

<sup>1</sup> Read before the American Surgical Association, April, 1898.

sides, unable to turn his head either to the right or to the left. At the request of Dr. J. W. Hawkins, who had charge of the case, I was called to see him on the 16th; reaching Glasgow at about 10 P.M. I found the boy bright and cheerful, not suffering much pain unless moved. In addition to the complete paralysis of motion the respiration was largely diaphragmatic, and we looked forward to the effect of the anæsthetic with some apprehension.

However, it was agreed that nothing but a search for the bullet and removal of the detached or depressed fragments of bone was to be considered. Accordingly, with the concurrence and assistance of Drs. J. W. Hawkins, M. B. Collins, W. Southworth, and W. M. Pritchitt, and after thoroughly cleansing the field of operation, I made an incision four inches in length parallel with and one inch to the right of the spinous processes of the cervical vertebræ, bisecting the point of entrance of the bullet, and, following its track as well as I could, cut down upon the laminæ of the vertebræ.

Pushing aside the structures, the point of entrance into the spinal canal came into view. The ball had struck the lower border of the third lamina, driving in a flap-like portion of the bone, and lodging in the canal.

The fragments of bone were first picked out, when the small bullet could be seen lying upon the cord, the point partially penetrating the dura. When this was removed there was a considerable flow of cerebro-spinal fluid, showing that the dura had been perforated. I learned subsequently from Dr. Hawkins that this flow continued in great abundance for ten or twelve days, saturating the dressings, the sheet and bedding, making frequent changes of them necessary.

The wound was dressed by first passing into the canal a strip of iodoform gauze to secure drainage, over this a quantity of bichloride gauze, which was then covered by a thick layer of absorbent cotton. He bore the chloroform well in spite of the partial paralysis of the respiratory muscles, supplied by spinal nerves.

For the subsequent history of the case I am indebted to Dr. Hawkins, who kept me advised from time to time by letter. On the 19th, the third day after the operation, his temperature was 99.6° F., pulse 76 to 80, had no control of bowels at times. A letter from Dr. Hawkins, dated June 24, stated that the wound

in the neck had entirely healed without suppuration. At that date he could move his left hand and arm, carry it to his face and scratch it. He was not able to move his right leg until the twenty-ninth day, which continued to improve from that time. He could not move the right arm for five or six weeks, motion returned in the thumb about the thirty-fifth day, and in a day or two in the second finger. On July 31 he was walking about with imperfect use of leg and arm. November 23 he was attending school and had regained his flesh. His right arm was still paralyzed but improving slowly. The fortunate result in this case is largely due to the faithful and intelligent after-treatment of Dr. Hawkins.

For three weeks after the injury the patient was unable to turn his head to the right or left. For the same length of time he was unable to raise his left hand to his nose, the itching of which gave him great annoyance, and it had to be scratched by the attendant frequently during the day and night. During the first two or three weeks he had occasional involuntary actions from the bowels, and for six weeks he had to be fed like an infant. Great emaciation followed the injury, his weight at the time of the accident was ninety-nine pounds, it fell to seventy pounds in five weeks. I should have mentioned that Dr. Hawkins stated that there was never any loss of sensation but rather a hyperæsthetic condition.

October, 1897, four years after the injury, young Diggs presented himself at my office, having grown taller and developed considerably, with perfect use of every limb except the right arm. This he could flex, and while in a flexed position could bring up to his face, but when in a straight position he could only carry it a few inches from the body.

It is not surprising to find that the first operation for fracture of the spine was done for gunshot injury, by Louis, in 1762, an open wound involving probably the arches, inviting interference, though that great surgeon recognized the principles involved.

For half a century or more after Cline's deliberately planned operation, an animated discussion, often acrimonious, was carried on as to the propriety of operation at all in fractures of the spine.

In 1867, Professor John Ashhurst collected statistics bearing upon the point, and drew from them conclusions—fully justified at that day, perhaps—decidedly unfavorable to the operation (laminectomy). As late as 1894, Manley, of New York, read a paper before the Second International Medical Congress, in which he deprecated operative treatment of fracture of the spine.

Cheever<sup>2</sup> says: "As far as laminectomy is concerned, while this may be justifiable sometimes, the latest statistics seem to show that the percentage of recoveries was better in cases not interfered with than in cases that were."

Gunshot injuries have been viewed from a somewhat different stand-point, and some of the opponents of operation in any case of simple fracture have looked with favor upon operation in gunshot wounds. Thorburn<sup>3</sup> tabulated fifty-six cases of trephining for injuries to the spine, and reaches the conclusion that no benefit can result from operations for most traumatic injuries to the spinal cord, and that operation is therefore unjustifiable. In spite of this emphatic expression of opinion as regards ordinary injuries of the spine, he makes the sweeping exception in favor of gunshot wounds by stating, as beyond dispute, that in cases of compound fracture of the arches, chiefly gunshot wounds, foreign bodies and bony fragments should be removed, and the wound treated antiseptically. No possible harm can occur from so obvious a procedure.

Pilcher,<sup>4</sup> while speaking guardedly of the probable benefit of operations in fractures of the spine, in which the lesion is caused by a force which acts upon a very limited segment of the column, speaks less reservedly of gunshot fractures as a class, in which there are special indications arising from a compound fracture, probably septically infected, for immediate enlargement of the external wound, removal of fragments, disinfection, and drainage.

Vincent<sup>5</sup> says: "Whatever be the nature of the injury to the cord, unless it be complicated by serious injury to the abdominal or thoracic viscera, and provided the gunshot

wound has involved the posterior or lateral parts of the spine at an accessible region, the surgeon should open up the track of the bullet as far as the vertebral arch, and, after investigation of the nature and extent of the lesion, extract any foreign bodies likely to compress or irritate the cord. If it be necessary to trephine the walls of the spinal canal, he should not hesitate to do so. Such treatment may be found beneficial, and, though sometimes useless, will never do any harm if practised under strict antiseptic precautions."

As in the skull, the gravity of the injury in gunshot wounds of the spine depends upon the damage done to the contents of the spinal canal, save in those complicated by damage to abdominal or thoracic viscera. It will be conceded that gunshot injuries of the spine are of graver significance in general than fractures from falls, blows, etc., and deserve to be considered in a class by themselves, as gunshot wounds elsewhere. They are compound, presumably septic *ab initio*, the projectile crushing and lacerating the structures with which it comes in contact, splintering bone, crushing and devitalizing the cord, when traversing it.

Gunshot injuries of the spine may be divided into three classes,—

- (1) Those that simply fracture the arches.
- (2) Those that invade the canal, crushing the cord and damaging the vertebræ.
- (3) Those complicated by serious injury to abdominal or thoracic viscera.

As to the first class of cases, the majority of surgeons of to-day would sanction and advise immediate treatment by laying open the track of the wound, clearing out all fragments of bone, laminectomy, if necessary, sterilizing the wound, draining, and applying antiseptic dressings. Observing the most rigid antiseptic precautions.

What shall be done with the second class of cases, those in which the ball has invaded the canal, lacerated the cord, and possibly buried itself in the vertebra? Dr. James<sup>6</sup> said, "If the spinal marrow is wounded, death follows inevitably."

Doubtless the great majority of these cases are doomed, yet some have survived such an injury for years. In spite of the dictum of Dr. James, severe laceration and even complete severing of the spinal cord are not incompatible with the prolongation of life for years.

Hawley<sup>7</sup> reports a case of gunshot wound of the spine, occurring September 19, 1884, ball (No. 32) entered back two inches to the left of the vertebræ, on a line with the seventh rib. Probe could be passed to near junction of the eighth rib with the dorsal vertebra. Severe shock with collapse for several days. Complete paralysis of sensation and motion below wound, including bowel and bladder, requiring catheterization of the latter. Complained of sensation of a tight band around his body on a line with the crest of the ilium, some involuntary twitching of the muscles of the lower limb, and slight reflex when toe of left foot was pinched. Had but little pain. Priapism frequent and prolonged. Wound healed in about twenty days. Seventy-three days after injury rigors for two days followed by high fever, 105° F., occurred, declined, and reached normal in about ten days. Marked tenderness of eighth, ninth, and tenth dorsal vertebræ.

From time of injury there was continued pain and tenderness across the abdomen in the skin, diminished by pressure. His general health improved to such an extent that he attended to the correspondence of a mercantile establishment, and subsequently became president of a bank, and was serving as postmaster at the time of his death, May 9, 1890, which was preceded by rigors and coma, five years and about eight months after the injury.

Post-mortem fifteen hours after death. Track of ball easily traced. The seventh and eighth dorsal vertebræ found softened and of a dark lead color. Point of left transverse process of the seventh dorsal had been cut with the ball. Left lamina of the eighth dorsal had been fractured and driven into the spinal foramen. Spinal cord had been nearly cut in two, about one-eighth remaining intact, and this was atrophied. The ends had retracted and formed "knotty tubercles." Spinal canal contained a small quantity of pus and showed evidences of inflammation. The ball



was found embedded in the body of the eighth dorsal, projecting about four lines into the canal.

In conclusion, the author expresses astonishment at the tenacity of life and the efforts of nature to repair the damage done. He states that he was "more thoroughly convinced of the superiority of conservative surgery over cutting and probing systems of the past."

Hawley's case demonstrates the possibility of an individual living for years with a completely divided cord, dying eventually from inflammation excited by abiding irritation of fragments of fractured bone and possibly the bullet. Had these been removed by operation and the patient survived, it seems not improbable that he might have lived years longer.

In the first of Vincent's cases, one of injury to the first lumbar vertebra, removal of the fragments of bone and of the bullet from the spinal canal was followed by complete recovery.

The late Professor Paul F. Eve, of Nashville,<sup>8</sup> relates a case of a soldier who, during the Civil War, while turning in his saddle and firing at a pursuing foe, was himself shot, falling from his horse. The pistol ball entered to the left of the spinal column, about an inch from the spinous process of the sixth dorsal vertebra, in the cavity of which or that of the seventh it is supposed to be lodged. He was immediately paralyzed except his arms and neck. After more than a year the paraplegia continued. He had no control of the left inferior extremity, and the right, which he moved a little or when aided in doing so by others, would frequently take on violent contractions, tonic and clonic spasms, and became forcibly flexed on the buttocks. Sensibility of limbs imperfect. He could urinate with difficulty and the bowels acted only from drastic purgatives.

An attempt was made to remove the ball by following the cicatrix into the vertebral cavity, but after using one crown of the trephine over what seemed the hole made by the bullet, fear of wounding the sheath of the spinal cord and thereby exciting inflammation led to an abandonment of the operation. This man was still living at the date of the article read, July, 1868.

He relates other cases of gravest injury to the spinal cord, where the patient lived from a few months to twenty-two years. In closing he says, "The conclusion, therefore, is indisputable, that death does not necessarily follow a division of the spinal cord."

Admitting, then, that the complete severing of the cord is not incompatible with the prolongation of life for years, what shall be done with this second class of cases? Shall we leave them to survive or perish without attempt to improve their chances of recovery? Admitting that nothing more could be done, would it not be better to do a laminectomy, remove all foreign bodies, spiculæ of bone, the bullet, if possible, and the devitalized tissue of the cord, thereby diminishing the dangers of meningitis and myelitis, and promoting more prompt healing of the wound? This would be the rational treatment of gunshot wounds elsewhere, why not in the spine? The only additional risk to which the patient would be subjected by this procedure would be shock. Should he survive, he would be freed from the persistent menace of conditions always favoring the development of local mischief, and life prolonged indefinitely so far as the spinal injury was concerned.

Some of the strongest and most advanced advocates of operative interference in cases of injuries of the spine, in certain cases, would regard injuries resulting in crushing of the cord as beyond the pale of justifiable operation. Thorburn regards a crushing injury of the cord as hopeless. White, in his conclusion says, "Operation is contraindicated by a history of such severe crushing force as would be likely to cause disorganization of the cord."

These views were expressed in regard to the crushing effect of blows, falls, etc., but would apply *mutatis mutandis* to gunshot injuries of the cord. Mr. Horsley dissents from this view. "I would repeat, therefore," he says, "that so far from its being unjustifiable to operate on the spine, owing to the possibility of the cord being hopelessly damaged, it seems to me criminal not to do so."

How far is the cord capable of regeneration and reunion when severed, and what might surgery do in this direction? The possibility of recovery of its function, if the cord be much damaged, was discussed by Cline in his classical case operated upon in 1814. As bearing upon this point he cites the well-known fact that divided nerves will unite, and the further fact that experimentation has shown that the spinal cord may be almost completely divided by incision and the animal recover.

Bode,<sup>9</sup> in speaking of stab-wounds, cites several cases of perfect healing of wounds of the spinal cord involving not quite half its diameter.

Thorburn made an analysis of twenty cases (undoubted) of wounds, by sharp instruments, of the cord or its membranes in human beings, and among them found only six deaths. The remainder recovered more or less completely, though not treated antiseptically. Undoubtedly in those cases where there was complete recovery there was complete regeneration.

Chipault says: "In cases of recent division of the cord by cutting instruments, in which it is not necessary to practise medullary resection, suture of the cord, or, strictly speaking, suture of its sheath, of the pia mater, is possible on the cadaver, and very probably would be found so on the living subject. The steps of the operation are very simple. A half circle of sutures of very fine silk having been applied to the anterior portion of the pia mater, the divided surfaces of the cord are brought together and kept in contact by hooked forceps attached to the meninges while these sutures are tied. After this has been done, another half circle of similar sutures is applied to the posterior part of the cord. If the cord has been incompletely divided, it will be found sufficient to apply a few lateral and posterior sutures. It often happens that one or more nerve-roots are found divided, together with the cord, particularly at the lumbar swelling, along which the nerves forming thick bundles take a parallel course. It would always be possible in such cases," the author states,

"to suture the peripheral end of the divided nerve, either to its central end or to an intact nerve-root corresponding to a portion of the cord placed below the seat of injury."<sup>10</sup>

Here the condition is vastly different from the laceration and crushing of the cord so frequently associated with fractures from blows, falls, and gunshot wounds. The incised wound, leaving the parts accurately in apposition, might well unite by first intention with restoration of function, while the lacerated ends of the cord, separated by devitalized tissue, could hardly accomplish a union by the efforts of nature that would restore function, if accomplished at all.

Maydl suggested that in cases of old division of the cord, or of its functional destruction over a certain extent from sclerosis, two fresh and healthy surfaces made by clean section might be brought together and maintained in contact by sutures. In a criticism of the proposal made by Maydl in these two categories of cases, Chipault says, "Such treatment is anatomically impossible."

On three subjects, examined after death from fracture of the spine, it was found that the retraction of the medullary segments and the extent of the sclerosis necessitated free resection, and that the inelasticity of the cord and the resistance of the ligaments, formed by the pia mater, prevented apposition of the cut surfaces.

Dr. Robert Abbe<sup>11</sup> says: "It still remains a problem, perhaps never to be solved, how to connect the lower segment of the cord with the upper when there is a gap of half an inch, and whether this union would restore functional connection with the brain, even though its reflex and independent activity be ever so good. The cases may yet be found where sufficiently narrow transverse lesions will allow the suturing of fresh-cut ends of the cord."

In Hawley's case the cord had retracted and the ends had formed "knotty tubercles."<sup>1</sup> We instinctively speculate

<sup>1</sup> Sir Astley Cooper "states ["Fractures and Dislocations"] that when a patient survives an injury causing division of the cord for some time 'bulbs' are organized at each end of it."

as to the possibility of trimming and approximating these cut ends and suturing them, thus restoring the continuity and with it the function of the cord.

In 1892, Leckie<sup>12</sup> suggested the feasibility of removing a sufficient amount of the spinal column, in cases of destruction of a small portion of the spinal cord after fracture, to permit of the approximation of the separated ends, by stitches. Shall we dismiss it with the curt comment *non possimus?*

The following are Leckie's words:

"In the epitome of September 24, paragraph 261, I noticed a criticism by Chipault on a proposal of Maydl and others to suture the spinal cord, holding such an operation to be anatomically impossible in the cases suggested, owing to the inelasticity of the cord and resistance of the ligaments. The question of spinal lesions is one in which I have for some time taken an interest, and the idea of resection and suture of the cord in certain cases has presented itself. The operation is one which, I hope, will not be lost sight of by the surgeons, and I believe, notwithstanding the statement of its anatomical impossibility, that it will yet be performed.

"It is unfortunately true that in spinal accidents its applicability must be very limited; but in these days when the surgeon feels that nothing almost should prevent him attempting relief, it is an operation which deserves a trial. It may be all the difference between years of helplessness and a life of comparative comfort and hopefulness.

"The operation I would propose is to shorten the spinal column in order to overcome the difficulties referred to, and so permit of the divided ends of the cord being placed in apposition and suturing of the membranes. Details of the operation would be required to be worked out on the cadaver, but there should be no insuperable difficulty in the removal of part or the whole of a vertebra or portions of two adjacent vertebrae, if necessary, by means of gouges or drills, interfering as little as possible with surrounding ligaments, having first ascertained by trephining that retraction of the cord is not so great, or the part requiring resection so extensive, as to render operation obviously impracticable.

"Disease only too often performs operations which shorten and variously modify the form of the spinal column, and the surrounding parts adapt themselves to the altered conditions. Is there, then, any vital objection to antiseptic surgery acting in a more scientific manner, trying by operation to restore something like life to some cases which, without its aid, must look forward to a future of such utter hopelessness?"

Maydl's suggestion as well as Chipault's criticism referred to old division of the cord, when it might be supposed that a certain amount of fixation and inelasticity of the cord had followed division and prevented approximation. Attempts at approximation immediately after injury might be more practicable, as in Briggs's case here cited.

Through the courtesy of Dr. Waldo Briggs, of St. Louis, I have been furnished the following notes of a case in his practice bearing upon the question of partial regeneration, at least, of the spinal cord after destruction by violence.

"Joseph Rothert, a boy seventeen years of age, while felling trees in Arkansas was injured by the trunk of a tree falling and pinning him to the ground. On his removal to the house it was discovered that there was complete paralysis of the lower part of the body from the waist line downward, incontinence of urine, etc. He was brought to St. Louis, and I operated on him January 5, 1898. Patient being very much exhausted from the journey, the operation was deferred until he could recuperate. Patient could not rest easy in any position, sleeping only at short intervals. His temperature at eight o'clock next morning was 101° F., pulse 100; on entrance, the day before, it was 99.5°, with a pulse of 98. The injury having occurred three weeks previous, there had developed on each side of the hip and over the sacrum bedsores which were devoid of sensation. The operation was by the usual method, a wide chasm being made, the bones were readily removed by bone forceps from the ninth, tenth, eleventh, and twelfth dorsal vertebræ. Numerous fragments of bone were found in the canal and were washed out. On tracing the cord, I found it had been completely severed at about the location of the tenth dorsal vertebra, and I at once conceived the idea of cutting off the ends of the cord and attempting to reunite them, for the reason that I had strong faith in the regeneration of the tissues of the cord. This method was adapted by carrying the sutures first transversely through the dura and pia mater, then longitudinally in order to prevent the splitting of the column. The sutures were pulled gently until there was apposition of the two ends, when they were tied. Four sutures of very fine catgut were used, and the after treatment of the wound was that as

adopted in other cases. There was considerable shock on the day following the operation. There has been a gradual improvement in both motion and sensation, the bedsores which were painless previous to the operation have become very painful. There is partial control over the bladder, motion of the muscles to the knee in one limb and in nearly the whole of the other limb.

"Improvement is so great that I feel assured if complete recovery does not ensue, yet there has been enough improvement to satisfy me that in nearly every case we meet the operation is justifiable."

Ostermeyer, after detailing a case of gunshot injury in the region of the tenth dorsal with the bullet lodged in the canal, as shown by autopsy, says: "There had been a total cutting of the cord, which at no time could have been diagnosed. The course of a case of gunshot wound may help to make a diagnosis of concussion, contusion, compression, or partial tearing of the cord possible, but in many cases there is no difference in the symptomatology. As it is hard to tell the degree and kind of injury, Demme advises that when the projectile is deeply situated or pieces of bone press on the cord, we should avoid resection or trephining, because we can beforehand form no definite idea of the true condition. In this case the course and seat of the bullet could not be determined."

No stronger argument could be urged for operative interference, it seems to me, than is here presented against it. If the difference in the symptomatology will not enable us to determine whether there is merely a fracture of the laminae, with depressed bone, perhaps,—when there would be little difference of opinion as to the propriety of operation,—or destructive injury of the cord with presence of foreign matter, when death must ensue, unless the patient can be rescued by operation, certainly it would seem that every patient should have the benefit of the doubt, especially if, as Erichsen says, "the operation *per se* can do no harm."

Upon this point Vincent<sup>13</sup> says: "By operation one



may hope to diminish the irritation, which leads to meningitis and myelitis. The motive which should chiefly lead the surgeon is the uncertainty of the diagnosis of the lesion of the cord, which may be only a compression, and the conviction that an operation is not dangerous."

Le Gros Clark, while admitting the possibility of benefit in fractures of the spine, where the arches only are involved, with limited depression, etc., says, "But where are these cases to be met with and how are they to be recognized?" Here, again, the argument is faulty. If we cannot distinguish between the cases that will be benefited by surgical interference, then it must be shown that the actual mortality is increased by operation, or it is our duty to give every patient with these injuries the benefit of the doubt.

It is not for us, with inverted thumbs, to seal the doom of the prostrate victim. Undoubtedly a very large proportion of such cases must and will die, but certainly it has not yet been shown that some otherwise doomed might not be rescued. What if we may never succeed in uniting the severed and retracted ends? Might we not by cleaning out the wound, removing the irritating agencies, and disinfecting the wound, diminish the dangers of myelitis and meningitis, and thus rescue and prolong the lives of some even though paraplegic?

In the third class of cases, where the ball has invaded cavities and viscera, the conditions which the complications present would influence the question of operation. In Whitaker's case, in spite of the fact that the ball had traversed the abdomen, operation was done and the patient recovered.

It is unfortunate that writers too often speak of the spine as a whole, and operations done upon it as if it were a matter of indifference as to what part of the column was attacked. Nunnally, in an address on surgery before the British Medical Association, in 1869, speaks of resecting the spine. Dr. H. A. Potter, of New York, as quoted by Eve,<sup>8</sup> made an incision from the second cervical to the third dorsal, and removed parts of the four inferior cervical and two supe-



rior dorsal vertebræ. Eve also (*supra*) says: "I am satisfied that this operation in the dorsal vertebræ, if not almost impractical, is certainly one of the most difficult in surgery." The context is often necessary to make clear the meaning.

I have succeeded in tabulating forty-nine cases of gunshot injuries of the spine treated since the aseptic era. Of this number twenty-four were subjected to operation, with eleven recoveries and thirteen deaths,—a percentage of 45.8 recoveries. Twenty-five were not operated upon, with eight recoveries and seventeen deaths.

Tabulated according to regions, we have in the cervical, eighteen cases, with nine operations, and four recoveries and five deaths.

Not operated upon, nine cases, with two recoveries and seven deaths.

Dorsal, we have twenty-six cases, with twelve operations, with four recoveries and eight deaths.

Not operated upon, fourteen cases, with five recoveries and nine deaths.

Lumbar, we have five cases, with three operations, three recoveries and no deaths.

Not operated upon, two cases, with one recovery and one death.

With improved technique and more thorough antiseptic precautions, it may be believed a larger proportion of recoveries might be anticipated.

While the cases I have tabulated have been limited to the period covered by the introduction of antiseptics, it may well be questioned whether antiseptic surgery has been rigidly followed in their treatment. The doubt upon this point militates somewhat against the value of the statistics offered, yet they show a decided preponderance in favor of operation. So, too, some of the operations can scarcely be dignified as such, since they totally fail to meet the indications.

## CONCLUSIONS.

(1) It is the duty of the surgeon to advise immediate operation in all cases of gunshot wounds of the spine, provided the wound has involved the posterior or lateral parts of the spine at an accessible part; unless the condition of the patient is such as to indicate clearly that he is hopelessly stricken.

(2) To wait to see whether nature is competent to restore the damage is to wait until irreparable damage has been done in many cases, rapid degenerative changes, meningitis, and myelitis. The delay permits of the continuance of conditions, the removal of which is the purpose of the operation. These considerations apply with greater force, if possible, in gunshot injuries than others.

(3) The presence of complications due to penetration of the great cavities and injury of the viscera will influence the question of operation, but not necessarily forbid it.

## ABSTRACTS OF PARTICULAR CASES COLLECTED FROM LITERATURE.

(1) Reporter, S. Bailey. Reference, Medical and Surgical Reporter, Philadelphia, 1879. Date, August 3, 1879, ball entered body midway between root of neck and top of shoulder-joint. Symptoms, complete paralysis of body and legs; neither sensation nor motion from top of sternum to soles of feet; retention of urine and bedsores; priapism came on ninth day and lasted eight days. Nature of operation, none. Subsequent course, great emaciation followed; arms and especially thighs atrophied. Result, died on twenty-third day. Region affected and post-mortem appearances, second dorsal vertebra removed and found to contain track of ball; cord disintegrated and in fluid state; adhesions at apex of right lung, and small smooth-walled cyst-like spaces at apices; patient had had years before bronchial hæmorrhage.

(2) Reporter, D. W. Bliss. Reference, Medical Record, 1881, Vol. xx. Date, July 2, 1881; President Garfield; ball entered right side, four inches from median line of spine and a line of eleventh rib. Symptoms, great pain in extremities; nausea and vomiting; incontinence of urine at first. Nature of operation, incisions made at various intervals to permit of escape of pus and secure drainage; small fragments of rib removed at intervals. Subsequent course, suppuration; pyæmia; exhaustion. Result, death, two months and fifteen days. Region affected and post-mortem appearances, bullet had fractured both right eleventh and twelfth ribs, three and a half millimetres to right of vertebral spines, passed through body of first lumbar vertebra, lodging in connective

tissue two and a half inches to left of spinal column and behind peritoneum, and had become encysted; rupture of splenic artery had occurred, causing fatal hæmorrhage; spinal cord was not injured.

(3) Reporter, W. P. Briggs, Case I. Reference, personal note. Date, April 7, 1897; female; ball entered two inches to left of spinous process, tenth dorsal; bullet located by X-ray and fluoroscope in spinal column. Symptoms, paralysis complete of lower limbs with loss of sensation. Period of operation after injury, same day. Nature of operation, linear incision from eighth dorsal to below top of sacrum; spinous processes of ninth, tenth, eleventh, and twelfth dorsal vertebræ cut off with angular forceps; bullet found embedded in laminæ and removed; then the laminæ on either side of four dorsal vertebræ removed; numerous particles of splintered bone in the canal carefully removed; wound irrigated daily. Subsequent course, case progressed nicely for a time; paralysis disappeared in a week, and healthy cicatrization took place; at fifth week a severe rigor occurred; evidence of meningitis set in and patient succumbed about sixth week. Result, died sixth week. Region affected and post-mortem appearances, pus found in canal at upper part of wound and almost complete degeneration of cord.

(4) Reporter, W. P. Briggs, Case II. Reference, personal note. Date, admitted to hospital March 13, 1897; male; five years before received gunshot wound, ball entering to right of spinous process, tenth dorsal. Symptoms, complete paralysis below wound; incontinence of urine, etc. Period of operation after injury, five years after injury; two days after admission to hospital. Nature of operation, after access to the canal found a piece of bone had been driven into cord and firmly fastened in the tissues; dura incised, bone dissected out, and wound of dura closed by fine catgut; bullet found in canal several inches above where bone was embedded in cord and readily removed; second portion of bullet in tissue to left of vertebra. Subsequent course, patient progressed well until fourth or fifth day, when pneumonia set in, proving fatal. Result, died sixth day after operation.

(5) Reporter, D. B. Brown. Reference, London Lancet, 1879. Date, January 22, 1879; bullet entered neck near posterior margin of sternomastoid, left side, upper portion of middle third. Symptoms, lost all use of arms and hands. Period of operation after injury, January 26, four days. Nature of operation, made free opening in middle; found processes of two adjacent vertebræ smashed and could feel what seemed the cord, pressure upon which caused patient to turn pale and rendered pulse imperceptible; next day found ball under ligamentum nuchæ and removed it. Subsequent course, wound healed rapidly, but original one continued to discharge pus and patient was sent to the Royal Victoria Hospital, Netley; no further report. Result, partial recovery. Region affected and post-mortem appearances, fracture of processes of two adjacent cervical vertebræ.

(6) Reporter, W. C. Bryant, Case I. Reference, International Journal of Surgery, New York, 1896. Woman, aged twenty years, shot in left side of neck, midway between clavicle and inferior maxilla and just pos-

terior to great blood-vessels. Symptoms, immediate paralysis of sensation and motion below diaphragm. Nature of operation, none. Result, death forty-two hours after accident. Region affected and post-mortem appearances, bullet had passed through body of second dorsal vertebra, penetrated the substance of the cord, and was found under the right scapula.

(7) Reporter, W. C. Bryant, Case II. Reference, *International Journal of Surgery*, New York, 1896. Male, colored, aged twenty-four years, shot in left side of neck, midway between clavicle and inferior maxilla, and just posterior to great vessels. Symptoms, immediate paralysis of sensation and motion below diaphragm. Nature of operation, none. Result, death fifty-eight hours after injury, due, in this case and previous, undoubtedly, "from paralysis of the diaphragm, when inflammatory process reached the origin of the phrenic nerve." Region affected and post-mortem appearances, bullet, 38 calibre, found embedded in substance of cord, between second and third dorsal vertebrae, having carried with it a piece of the victim's shirt-collar.

(8) Reporter, W. J. Burt, Case I. Reference, *Daniel's Texas Medical Journal*, 1886-87. Date, October 28, 1885; female, aged twenty-six years; ball, 45 calibre pistol, entered body three inches to right of spine, opposite eighth dorsal vertebra; passed to the left, lodged between eighth and ninth left ribs, from which point it was removed. Symptoms, complete paralysis of motion and sensation below seat of injury; retention (suppression?) of urine for six days. Nature of operation, none. Subsequent course, large, gangrenous sloughs over sacro-lumbar region; fever; paralysis of upper extremities, coma, and death. Result, died November 16, nineteen days after injury. Region affected and post-mortem appearances, bullet pierced lamina and base of spinous process of eighth dorsal vertebra; spicula of bone forced against meninges and cord; lacerating former and contracting canal to one-half normal size; extradural hæmorrhage; osteomyelitis of seventh and eighth dorsal vertebra and destructive degeneration of intervertebral substance; dura adherent to cord and canal; cord softened and degenerated for three inches.

(9) Reporter, W. J. Burt, Case II. Reference, *Daniel's Texas Medical Journal*, 1886-87. Date, February 8, 1886, male, colored, aged twenty-eight years; pistol ball, 45 calibre, entered back three and a half inches to left of spinal column, and four inches above crest of ilium, in direction of first lumbar vertebra. Symptoms, paralysis of lower extremities; retention of urine and fæces. Period of operation after injury, two days after injury. Nature of operation, incision down on rib at orifice of entrance and removed piece of bone. Result, died at 11 P.M.; death, no doubt, hastened by surgical interference. Region affected and post-mortem appearances, ball had passed behind psoas muscle, kidney, and peritoneum; entered intervertebral foramen between last dorsal and first lumbar, entering the canal, and lodging partly in first and partly in second lumbar vertebrae, fracturing the pedicles and articulating surfaces of both bones; cord and meninges in track of ball almost totally destroyed.

(10) Reporter, W. J. Burt, Case III. Reference, Daniel's Texas Medical Journal, 1886-87. Date, November 25, 1885; male, aged twenty-seven years; pistol ball, calibre 38, entered about four inches to right of seventh dorsal vertebra, passing in direction of spinal column. Symptoms, paralysis of lower limbs, abdominal muscles, and pelvic viscera; retention of urine and feces for two weeks. Period of operation after injury, November 28, three days after injury. Nature of operation, incision, three inches in length, along right side of spinous processes of seventh, eighth, and ninth dorsal vertebrae; incision connected with track of ball; bullet not located; drainage-tube. Subsequent course, wound healed rapidly; December 8, large slough over sacrum; septic fever. Result, died 154 days after injury. Region affected and post-mortem appearances, ball had entered ninth dorsal vertebra at base of right transverse process, passed a little downward, and lodged in canal; ball completely embedded in meninges and spinal cord; small spicula of bone penetrated cord; cord softened but partly intact.

(11) Reporter, Coppinger. Reference, Transactions of the Academy of Medicine, Ireland, 1883. Date, 1882; male, aged twenty years; ball of small size penetrated right side, between sixth and seventh ribs, about eight inches from spine, and seemed to have lodged in spinal column. Symptoms, paralysis of bladder and rectum immediately. Nature of operation, none. Subsequent course, thirteen months after accident could walk with difficulty; gait ataxic, ankle-clonus well marked; control of bladder and rectum had been regained. Result, partial recovery.

(12) Reporter, J. Ward Cousins. Reference, London Lancet, 1891. Date, April 25, 1891; male, aged twenty-two years; pistol ball entered neck four inches above left clavicle and one and a half inches to left of median line of neck; ball presumably lodged high up in spinal column. Symptoms, complete paraplegia and anesthesia of lower extremities; priapism, regarded by the author as a symptom of great gravity in spite of leading opinions to the contrary. Nature of operation, none. Result, death forty-three hours after admission to hospital. Region affected and post-mortem appearances, ball had penetrated anterior surface of fourth cervical vertebra, passed diagonally across spinal column, and emerged behind root of transverse process of seventh cervical vertebra; spinal cord badly lacerated, but not completely divided.

(13) Reporter, R. M. Cunningham. Reference, Transactions of the Southern Surgical and Gynecological Association, 1888. Woman, aged thirty-two years; shot September 8, 1887; ball, 38 calibre, entered left anterior aspect of neck, midway of vertical diameter, passing backward between trachea and vessels, and lodged in left side of spinal column. Symptoms, partial paralysis of left arm and leg. Period of operation after injury, next day. Nature of operation, common carpenter's gimlet passed along track, and screwed in to base of bullet; withdrawn with considerable force. Subsequent course, paralysis unimproved; evidence that left anterior column of cord was injured; complication of croupous pneumonia. Result, death eighth day. Region affected and post-mortem appearances, slight laceration of left anterior column of cord, caused by bone.

(14) Reporter, D. Cushing. Reference, Bulletin of Johns Hopkins Hospital, 1897. Date, November 6, 1896; woman, aged twenty-seven years; shot twice in neck; wound of entrance right side of neck, on a level with cricoid cartilage; bullet lodged in sixth cervical vertebra. Symptoms, agonizing pains of "pins and needles" character, especially in arms; motor paralysis complete on right side below level of Thorburn's fifth root group on left brachial monoplegia up to same level,—viz., for deltoid, biceps, and supinator longus muscles; anæsthesia on left side. Nature of operation, none. Subsequent course, lesion presumably due to intramedullary hæmorrhage; motor paralysis disappeared gradually. Result, recovery.

(15) Reporter, T. Dana. Reference, American Journal of the Medical Sciences, 1876, Vol. lxxii, p. 120. Date, man, aged thirty-three years; October 16, 1875; rifle ball penetrated right side, between eighth and ninth ribs, four inches below axillary border. Symptoms, shock and usual hæmorrhage; paralysis of motion and sensation below site of wound. Period of operation after injury, none. Subsequent course, in two weeks bedsores, which laid bare sacrum, both ilia and both femora nearly their whole extent. Result, death February 7, 1876, 113 days after injury. Region affected and post-mortem appearances, flattened bullet at site of eleventh dorsal vertebra (left side), spinal canal, and adherent to membranes; cord softened and disintegrated below the lesion.

(16) Reporter, F. Dedolph. Reference, Transactions of the Minnesota Medical Society, 1882. Date, May 2, 1881, ball broke clavicle, passed through lungs, lodging in spinal column, where it still remains; pulmonary hæmorrhage and hæmatothorax. Symptoms, left arm paralyzed from injury to brachial plexus; paralysis of lower extremities, bladder, and bowels; ball supposed to be lodged in body of fifth cervical vertebra, indicated by persistent neuralgia. Nature of operation, none. Subsequent course, hæmatothorax absorbed; paralysis of left arm wore off, but persisted in lower extremities. Result, partial recovery.

(17) Reporter, Delorme. Reference, Gazette des Hôpitaux de Paris, 1890, Vol. lxiii, p. 249. Date, in 1870; man, aged forty-eight years; wound in base of neck, left side, by musket-ball; passed obliquely backward and downward, appearing under the skin on spinal border of scapula on level with its spine, and removed. Symptoms, no spinal symptoms; suppuration lasting seventeen years; radiating pains in left upper extremity and left half of neck. Period of operation after injury, seventeen years. Nature of operation, lamina of seventh cervical vertebra totally removed, laying bare medullary envelope; mass of callus removed; portion of bullet subsequently removed by M. Motz from dorsal column (upper dorsal region). Subsequent course, patient suffered greatly between first and second operation. Result, ten months after operation patient comparatively comfortable. Region affected and post-mortem appearances, upper dorsal region.

(18) Reporter, Justyn George D. Douglass. Reference, London Lancet, 1887, p. 255. Date, September 11, 1886; ball penetrated at level of tenth dorsal vertebra, a little to left of mesial line. Period of opera-

tion after injury, three days. Nature of operation, track of bullet followed to first lumbar vertebra and transverse process of twelfth dorsal removed, but bullet not found; track of bullet scraped and cleaned with solution of chloride of zinc, forty grains to the ounce. Subsequent course, in seventeen days wound healed, except at upper part of secondary abscesses; paralysis and bedsores developed. Result, death nearly four months after, January 6, 1887. Region affected and post-mortem appearances, bullet completely embedded in twelfth dorsal vertebra, anterior to transverse process; cord pressed upon but not penetrated by foreign body; small spiculæ of bone and pieces of cloth, which had been driven in, were afterwards detached; no apparent change in cord or its membranes.

(19) Reporter, H. C. Dunnaraut. Reference, *Memphis Journal of the Medical Sciences*, 1889-90, Vol. i, pp. 142-3. Date, March 14, 1889; pistol ball, 38 calibre, in dorsal region. Symptoms, not given. Period of operation after injury, third day. Nature of operation, several spiculæ of bone removed. Result, died six days after injury. Region affected and post-mortem appearances, laminae of second and third dorsal vertebrae shattered and cord completely severed.

(20) Reporter, W. J. Falkner. Reference, *Medical Press*, West New York, Buffalo, 1885-86. Date, July 11, 1885; boy, aged thirteen years; shot in dorsal region; ball, 32 calibre, entered at about level of spinous process of tenth dorsal vertebra in median line. Symptoms, paraplegia and absolute anæsthesia of lower extremities from line of distribution of ninth and tenth intercostal nerves to feet; retention of urine, and urine bloody. Nature of operation, none. Result, death July 28, following chill, seventeen days after injury. Region affected and post-mortem appearances, autopsy twenty-eight hours after death; wound of entrance healed; ball had entered canal, chipping off and carrying into canal a small fragment of right lamina of tenth dorsal vertebra; opposite upper border of eleventh vertebra cord was found completely perforated with softening above and below point of perforation; ball found firmly embedded in body of eleventh dorsal vertebra and removed with little alteration in shape.

(21) Reporter, Forgues. Reference, *Archives de Médecine et Pharmacie militaire*, 1883. Male, aged thirty years; received in a duel a pistol wound, ball entering chest under right clavicle. Symptoms, expectoration bloody; breathing diaphragmatic; complete paralysis of lower extremities and of bladder and rectum; no plantar reflex; hyperæsthesia at level of mammæ; below this sensation diminished. Nature of operation, none. Result, death, from asphyxia, forty hours after accident. Region affected and post-mortem appearances, bullet passed through the lung and between second and third dorsal vertebra without fracturing the bone; cord crushed; spherical ball (diameter eight millimetres) lodged in canal.

(22) Reporter, W. R. Gowers. Reference, *Transactions of the Clinical Society of London*, 1878. Vol. xiv, pp. 24-32. Date, October 10, 1876; male; fired a small revolver into his mouth; bullet passed through



tongue, missing soft palate, and lodging in spine. Symptoms, paralysis of right arm and leg. Nature of operation, none. Result, died sixty hours after injury. Region affected and post-mortem appearances, ball passed through body of second cervical vertebra and lodged between the arches of atlas and axis, passed behind vertebral artery, which was uninjured; bullet did not penetrate the dura, but a spiculum of bone had been forced through the dura and was adherent to the cord; cord intact but badly bruised.

(23) Reporter, Ed. C. Harwood. Reference, Bulletin of the Medico-Legal Society, New York, 1880. Female, aged forty-eight years; two balls entered mouth, passed through tongue, and embedded themselves in cervical vertebra. Symptoms, not given. Period of operation after injury, third day. Nature of operation, first bullet removed by enlarging opening with scalpel; second bullet was not extracted. Subsequent course, patient lived three months; abscesses forming. Result, death. Region affected and post-mortem appearances, odontoid process necrosed and disappeared; anterior portion of atlas fractured but reunited; the spinous processes almost destroyed; ball found between second and third cervical vertebræ.

(24) Reporter, J. E. Hawley. Reference, St. Joseph (Mo.) Herald, 1890, p. 519. Date, September 19, 1884; ball entered back two millimetres to left of vertebra on line with seventh rib; traced with probe to near junction of eighth rib with vertebra. Symptoms, complete paraplegia; wound healed in twenty-one days, with only slight pus-formation and no sloughing or abscesses; eighth, ninth, and tenth dorsal vertebræ remained tender and painful; gradual improvement in general; none in paraplegia; continued in active business in store, later served as bank president, and was postmaster at time of death. Nature of operation, none. Result, death five years after injury preceded by severe rigors. Region affected and post-mortem appearances, seventh and eighth dorsal vertebræ found softened and dark lead color; point of left transverse process of seventh dorsal vertebra cut by ball, and left lamina of eighth fractured and driven into spinal foramen; spinal cord nearly severed in two, one-eighth only remaining; cut ends of cords retracted, forming "knotty tubercles"; ball embedded in eighth dorsal vertebra.

(25) Reporter, Jabez N. Jackson. Reference, Langsdale's Lancet, 1896. Date, July 27, 1896; ball, 44 calibre, entered back of neck, near margin of occipito-acromial fold of trapezius, three or four inches above acromion process; ranging downward and slightly forward. Symptoms, complete motor and sensory paralysis from level of third intercostal space downward; priapism; tingling pain in tips of fingers. Period of operation after injury, same day. Nature of operation, laminæ from sixth cervical to third dorsal vertebra were removed; operation arrested by shock; no injury to cord perceptible. Subsequent course, partly rallied from shock, but died in about twelve hours. Region affected and post-mortem appearances, ball penetrated fifth cervical vertebra internal to transverse process, passed through body into spinal canal one inch



above limit of operation; cord injured in removal of ball, and its conditions from original lesion not known.

(26) Reporter, S. Lamb. Reference, *Journal of the American Medical Association*, July 9, 1887. Date, May 8, 1864; soldier; bullet entered just to left of middle line, above crest of ilium, left side, and passed to right upward and forward. Symptoms, lost use of lower limbs; urine drawn for four days; feces removed by rectal spoon for a long time; gradual improvement; in 1865 appointed clerk in the Treasury Department, and had use of all except left foot; married in 1869; in 1874, Dr. Lincoln opened abscess of left hip and removed pieces of flannel; in 1881, after complaining for some time with headache, tetanic spasm; was unconscious, followed by other spasms in 1882 and death. Nature of operation, none. Result, died eighteen years after injury. Region affected and post-mortem appearances, last four lumbar vertebræ involved, abundant new formation of bone, bodies of fourth and fifth lumbar excavated posteriorly; portions of bodies of third and fifth, with most of fourth, and intervening cartilages ossified into one piece; cauda equina opposite second lumbar normal; below this nerves matted together and in the mass small bits of bullet and larger pieces of bone; bullet (one ounce ball) lay in depression in posterior part of body and adjoining left lamina of fifth lumbar vertebra.

(27) Reporter, Morris. Reference, *Académie de Médecine de New York, Gazette hebdomadaire de Médecine et de Chirurgie*, 1886, p. 1008. Ball fractured tenth dorsal vertebra. Symptoms, paraplegia caused by compression of cord by fragment of bone. Period of operation after injury, operated seven days after injury. Nature of operation, elevated fragment; ball not found. Subsequent course, complete amelioration of right paralysis; persistence of left. Result, partial recovery.

(28) Reporter, H. H. Mudd, Case I. Reference, *Transactions of the American Surgical Association*, Vol. ix. Ball passed through fourth cervical laminæ, fracturing them. Symptoms, anæsthesia of opposite side and paresis of same side. Period of operation after injury, soon after injury. Nature of operation, bullet removed. Subsequent course, prompt relief and rapid healing of wound. Result, complete recovery.

(29) Reporter, H. H. Mudd, Case II. Reference, *Transactions of the American Surgical Association*, Vol. ix. Dorsal. Period of operation after injury, some months after injury. Nature of operation, division of mass of connective tissue surrounding cord; could not be entirely removed. Result, recovery; not much improved.

(30) Reporter, H. H. Mudd, Case III. Reference, *Transactions of the American Surgical Association*, Vol. ix. Male, stout, healthy man; involvement of eleventh dorsal vertebra. Symptoms, not given, except that fever was still present from the inflammatory process set up. Period of operation after injury, eight or ten days after injury. Nature of operation, removed laminæ of two lower dorsal and of first lumbar vertebræ. Result, died from shock. Region affected and post-mortem appearances, bullet found in spinal canal three or four vertebræ below point of entrance.

(31) Reporter, Ninné Giovanni. Reference, *La Riforma Medica*, Anno v, No. 5, "Contributo allo Studio delle Lesions violente del Midullo spinali Sindrome Tenomeni ca di Brown-Séquard." Date, January 30, 1887, soldier, shot in chest anteriorly; ball entered chest anteriorly, passing through third intercostal space on right, and lodged just below spine of scapula, on left side. Symptoms, complete motor paralysis of left leg, also paralysis of sensation of heat and cold, and paresis of pain of right leg and right half of body below fourth rib; tactile and muscular sensibility intact on both sides; knee-jerk, left side, slightly accentuated; frequent painful contractions of both legs most marked in left; painful girdle about thorax; disturbances of micturition. Nature of operation, none. Result, complete recovery. Region affected and post-mortem appearances, *probable lesions*: perforation of third dorsal vertebra with fracture of transverse processes of third and fourth vertebrae, or there may have been simply compression of cord, by dislocations of fragments of the fracture; involvement of left half of spinal cord, as shown by Brown-Séquard's symptomatic syndrome.

(32) Reporter, not given. Reference, *New York Medical Journal*, 1877. Wound of back not far from lower angle of scapula. Symptoms, paralysis of both arms and legs. Nature of operation, none. Subsequent course, paralysis of arms disappeared one month later, and after one year slight improvement in one lower extremity. Result, partial recovery.

(33) Reporter, not given. Reference, *American Medical Weekly*, New York, 1882. Date, May 31, 1862; patient, a soldier, was struck by minie-ball four inches to right of spinous processes of lumbar vertebra, nicking inferior border of twelfth rib. Symptoms, experienced a sensation of intense cold; returned to military duty in November of same year, and served till close of war (1865); afterwards suffered considerably with back; in February, 1875, his body was drawn over to right side, right thigh flexed on his body and leg on thigh. Period of operation after injury, twelve years and eight months. Nature of operation, February 13, 1875, removed bullet from body of first lumbar vertebra with small pieces of bone. Subsequent course, improvement after operation, but later suppuration occurred, fever, pain, and swelling on left side; opposite entrance of ball, pus, fragments of bone, and later a piece of cloth, two inches long by one and a quarter inches thick, came away from right side, also an exfoliation from body of vertebra three-fourths inch across and three-eighths inch thick. Result, complete recovery.

(34) Reporter, not given. Reference, report of the United States Marine Hospital Service, 1886. Date, February, 1884; male, aged twenty-six years; received pistol shot in back of neck; sent to hospital; discharged cured in April, 1884. Symptoms, in June, 1884, entered Detroit Hospital with severe paralysis agitans, involving head; had convulsions, July 5, 7, and 10. Nature of operation, none. Result, death July 10, 1884, preceded by severe convulsions. Region affected and post-mortem appearances, ball, 32 calibre, entered between axis and atlas and lodged in canal, pressing upon cord with which it was in contact: it

had fractured the atlas in two places, one-half inch apart, and reunion had taken place; ball had become encysted; cord not lacerated; death from rupture of cyst.

(35) Reporter, Nicholas Ostermeyer. Reference, *Pesther medicinisch-chirurgische Presse*, 1893. Date, February 2, 1892; girl, aged seventeen years, shot in back at level of tenth dorsal vertebra. Symptoms, complete paralysis of lower limbs and bladder; all reflexes absent; pain in back disappeared in two or three weeks; incontinence of urine and fæces set in and lasted until death; by middle of March there was contraction of lower limbs with lightning-like pains in them; no atrophy; bedsores and septic infection. Nature of operation, none. Result, died June 11, three months after injury. Region affected and post-mortem appearances, projectile had penetrated the spinal canal and lay in a softened, grayish-yellow, smooth-walled cavity; the wall consisting of thickened membranes of the cord; the cord was lacking in its entire breadth at this point; besides there was bronchitis, œdema of lungs, and purulent cystitis.

(36) Reporter, S. P. Perkowske. Reference, *Vayenno Medical Journal*, St. Petersburg, 1879. Soldier, wounded November 22, 1877, in cervical region. Symptoms, loss of consciousness; paralysis of upper and lower extremities; most marked on left side. Period of operation after injury, July 14, 1878, eight months. Nature of operation, bullet removed by gutter sound knife and French spatula. Subsequent course, slight improvement for three days. Result, death fifth day after operation, eight months after injury. Region affected and post-mortem appearances, autopsy thirty-seven hours after death; arches of third and fourth cervical vertebræ greatly thinned and denuded of periosteum; third, fourth, and fifth arches are grown to dura and dura to cord; cord altered opposite third and fourth vertebræ; evidences of intradural hæmorrhage.

(37) Reporter, R. Pespoli, June 2, 1872. Reference, *Giornale Medico del Ro Esercito e della Ro marina*, Rome, 1895, Vol. xliii. Soldier (age not given); bullet entered lower left cervical triangle, passed in direction of sixth cervical vertebra. Symptoms, paralysis of upper and lower extremities, bladder, and rectum; diminished sensibility; priapism. Nature of operation, none. Result, died on fifth day. Region affected and post-mortem appearances, ball had perforated—not fractured—sixth cervical vertebra; rotated somewhat and laid perpendicularly in spinal canal; medulla completely destroyed.

(38) Reporter, Charles Phelps. Reference, *New York Medical Journal*, 1896. Male; bullet, .32 calibre, passed through tongue from tip to base and entered the posterior wall of pharynx to left of epiglottis. Symptoms, great pain in back of neck; internal hæmatogenous jaundice developed on fifth day; stupor and death on tenth day. Nature of operation, none. Result, died tenth day after injury. Region affected and post-mortem appearances, subpharyngeal connective tissue gangrenous at site of wound; bullet lodged between second and third cervical vertebræ at base of transverse processes, both of which were

fractured; spinal membranes and cord uninjured, but they had been transuded by the gases of decomposition and other evidences of septic inflammation in cranial cavity.

(39) Reporter, J. L. Powel. Reference, *American Journal of the Medical Sciences*, 1880. Date, April 29, 1880; soldier, aged twenty-one years; pistol ball, 38 calibre, entered left side of neck, passed through spinal column at seventh cervical and first dorsal vertebrae, and lodged in right trapezius muscle. Symptoms, complete paralysis of motor and sensory of lower extremities, and paresis of upper extremities, and numbness of right hand. Period of operation after injury, same day. Nature of operation, ball removed from substance of right trapezius. Subsequent course, no pain; respiration easy and not accelerated; became unconscious by noon of next day. Result, death next day, at 5 P.M. Region affected and post-mortem appearances, incomplete fracture of neck of first rib; carried away pedicle of first dorsal vertebra, nearly severed spinal cord, and carried away greater portion of right lamina of first dorsal vertebra; irregular congestion of lungs.

(40) Reporter, T. F. Prewitt. Male, aged fifteen years; ball (22 calibre) entered posterior part of neck to right of spinous process of fourth cervical vertebra. Symptoms, immediate paralysis of upper and lower extremities, complete on right side; slight motion of left foot; hyperæsthesia, respiration diaphragmatic. Period of operation after injury, next day. Nature of operation, incision four inches in length parallel to and one inch to right of spinous process of right cervical vertebrae down to laminae; portion of lamella of third cervical picked out of canal, and bullet which had impinged upon and penetrated dura removed. Persistent flow of cerebro-spinal fluid followed removal of ball for some time. Subsequent course, gradual improvement in all the symptoms; wound healed kindly and without suppuration. Result, complete recovery.

(41) Reporter, W. S. Pyle. Reference, *ANNALS OF SURGERY*, 1894. Date, November 22, 1893; male, aged twenty-two years; bullet wound of spine over region of last dorsal vertebra. Symptoms, sensation intact, but loss of motion from hips down one hour after injury; excessive pain in legs. Period of operation after injury, same day. Nature of operation, linear incision over region of wound and portions of three laminae removed; piece of bullet found loose in canal and removed, having entered between lamina of twelfth dorsal and first lumbar; cord presented contused appearance and was split in the middle; evidence of spinal hæmorrhage slight. Subsequent course, wound healed by first intention; pain disappeared after operation; sensation gradually returned, and motion first noticed seven days after operation; no bed-sores; plaster jacket applied. Result, partial recovery; author thinks due to operation and subsequent treatment.

(42) Reporter, T. G. Richardson. Reference, *New Orleans Medical and Surgical Journal*, 1882-83. Date, December 10, 1882; ball entered left chest in front of and one inch below coracoid process; bruised, elevated, and painful spot appeared over sixth and seventh dorsal vertebrae.

Symptoms, complete motor and sensory paralysis from ensiform cartilage down; loss of sensation as high as third dorsal posteriorly; retention of urine. Nature of operation, none. Subsequent course, evidence of consolidation of lungs and bedsores developed. Result, death, December 24, fourteen days after injury. Region affected and post-mortem appearances, ball (38 calibre) fractured left third rib in entering chest; ranged downward, perforating left lung near its root; struck sixth dorsal vertebra at junction of body with its pedicle, passed into canal, perforated cord, and emerged from canal between fifth and sixth dorsal vertebrae, lodging in muscles of back; ball passed directly through cord, leaving an anterior and a posterior bridge; cord had undergone softening for an inch or more above and below.

(43) Reporter, Severaneau. Reference, *Langenbeck's Archiv für klinische Chirurgie*, 1888, Vol. xxxvii, pp. 664-665. Date, January 24, 1888; boy, aged sixteen years; ball entered three inches to left of spine, fracturing second dorsal vertebra. Symptoms, paralysis came on gradually, in six days involving upper and lower extremities, bladder, and rectum. Period of operation after injury, not stated. Nature of operation, followed track of ball to posterior arch of second dorsal vertebra which was splintered; removed bullet by electric forceps; ten grammes of pus escaped from track of bullet. Subsequent course, recovery complete in six months. Result, recovery. Region affected and post-mortem appearances, splintering of arch of second dorsal vertebra under which lodged the bullet.

(44) Reporter, A. R. Small. Reference, *Journal of the American Medical Association*, 1886. Date, May 2, 1886; male, twenty-three years of age; pistol ball (32 calibre) struck the right eighth rib two inches external to costal cartilage. Symptoms, sensation lost in right leg below knee; motion not impaired; left leg hyperæsthetic below knee, and motion slightly impaired; internal hæmorrhage. Nature of operation, none. Result, death May 4, two days after injury. Region affected and post-mortem appearances, ball had wounded pleura, liver, and right kidney, lodging in spinal canal on posterior surface of eleventh dorsal vertebra.

(45) Reporter, Thorburn. Reference, *Contribution to Surgery of the Spinal Cord*. Date, May 10, 1886; female, aged thirty-seven years; revolver ball, fired at short range, entered immediately below and behind left mastoid process, passing downward and to the right; wound healed in two weeks; bullet lodged superficially three inches to right of fifth cervical vertebra. Symptoms, immediate paralysis of both upper and lower extremities; complete loss of sensation below neck; diaphragmatic breathing and incontinence of urine and feces. Period of operation after injury, five weeks. Nature of operation, bullet removed. Subsequent course, pain and tenderness of cervical spines; paralysis of upper extremities complete; that of lower less; could raise left leg from bed; diaphragmatic breathing; continued incontinence of urine and of feces; completely recovered from in next few months, but not, however, of locomotion. Result, died within twelve months.

(46) Reporter, E. Vincent, Case I. Reference, *Bulletin et Mémoires de la Société de Chirurgie*, Paris, 1891. Male, aged thirty-seven years; bullet entered at level of tenth dorsal vertebra. Symptoms, immediate paralysis of lower extremities. Period of operation after injury, two days after. Nature of operation, lamina of eleventh dorsal vertebra found perforated; ball extracted, then a large spicula of bone. Subsequent course, slight amelioration followed by myelitis. Result, death after ninety-four days.

(47) Reporter, E. Vincent, Case II. Reference, *Bulletin et Mémoires de la Société de Chirurgie*, Paris, 1891. Male, aged eighteen years; ball (calibre 11 millimetres) entered dorsal region between tenth and eleventh vertebræ. Symptoms, complete destruction of cord. Period of operation after injury, third day. Nature of operation, lamina of tenth dorsal vertebra fractured; ball found and extracted after enlarging opening. Subsequent course, slight amelioration followed by fever. Result, death on eighth day. Region affected and post-mortem appearances, cord completely crushed.

(48) Reporter, E. Vincent, Case III. Reference, *Bulletin et Mémoires de la Société de Chirurgie*, Paris, 1891. Date, March 5; male, thirty-five years of age; bullet entered lumbar region at level of first lumbar vertebra to right of spinous process. Symptoms, sensibility is preserved; pain; micturition is difficult; can move legs but cannot raise them from bed. Period of operation after injury, two days after. Nature of operation, found lamina of first lumbar vertebra fractured; perforated with aid of trephine and removed fragment of bone and portion of bullet; canal free; meninges not compressed; remainder of bullet not found. Subsequent course, pain persisted; micturition always difficult; jaundice second day and on seventh stiffness of muscles of neck; signs of meningo-myelitis; walking in three weeks with aid of crutches and improvement continues. Result, partial recovery.

(49) Reporter, Whittaker. Reference, *International Medical Magazine*, Philadelphia, 1896. Date, June, 1896; female; ball entered abdomen in region of stomach. Symptoms, paraplegia complete and absolute. Period of operation after injury, July 21, 1896, about one month. Nature of operation, long incision in lower dorsal region over spinal column; arches of eighth, ninth, and tenth dorsal vertebræ removed; bullet found embedded in body of ninth dorsal vertebra, protruding bone into spinal canal; compressing cord, which seemed considerably broken up; bullet had been located by X-rays. Subsequent course, wound healed by granulation, but bedsores persisted, but in August bedsores slowly healing and general condition good. Result, partial recovery.

## RECAPITULATION.

Region.	Number of cases.	Cases operated upon, deaths.	Cases operated upon, recoveries.	Cases not operated upon, deaths.	Cases not operated upon, recoveries.
Cervical .	18	5	4	7	2
Dorsal . .	26	8	4	9	5
Lumbar .	5	0	3	1	1
Total .	49	13	11	17	8

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- <sup>11</sup> New York Medical Record, Vol. xxxviii, pp. 85-92.
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## TREATMENT OF FRACTURE OF THE PATELLA.<sup>1</sup>

By LEWIS A. STIMSON, M.D.,

OF NEW YORK,

SURGEON TO THE NEW YORK AND HUDSON STREET HOSPITALS; PROFESSOR OF  
SURGERY, CORNELL UNIVERSITY.

THE subcutaneous position of the patella, its accessibility to surgical procedures, and the simplicity of the indications created by its fracture are such that it might easily have been supposed that in the great changes in treatment wrought by the extension of operative methods under antiseptic protection a consensus of opinion would promptly have been reached as to the proper and most advantageous method of treating fractures of this bone. And yet, although it was one of the earliest to be reached in this extension, it may fairly be said that concerning no other injury are more widely different opinions held and a greater number of methods recommended. It is interesting and may be profitable to consider the causes of this condition, and endeavor to determine to what extent and under what circumstances operative interference is advisable, and which of the many methods are most worthy of confidence.

The desired answers can be most readily found, I think, by study of the objects sought and of the obstacles and dangers to be avoided; but one most serious fact underlies the whole subject and must be constantly kept in mind,—namely, the injury does not in itself endanger life, and its treatment by methods that carry no risk to life furnishes a large measure of success when those methods are properly applied. Consequently, resort to a method which involves risk to life or

<sup>1</sup> Read before the New York Surgical Society, April 12, 1898.



of such disability as is produced by ankylosis or amputation can be justified only when that risk is very small or when the existing conditions are such that the functional result by another method would probably be much inferior to that commonly obtained.

The pathological conditions are so well known that I shall only briefly mention those which are directly concerned in the question under consideration, because of the indications they create and of their influence upon the result of treatment. These are the occasional rotation of either fragment, the interposition between the fragments of a fibro-periosteal fringe, or, more important, of long strips of fascia, and the distention of the joint by blood or exudate.

Rotation of either fragment may take place about a transverse axis. It is most frequent in the lower fragment, and is there such that the fractured surface is directed forward. In the upper fragment I have seen it only in old cases, by the aid of the X-rays, the fractured surface directed backward; it there seems to be the result of the cicatricial contraction of the torn edge of the lateral expansions. The effect of this displacement is to prevent close union of the fragments and to limit repair to a more or less thin, fibrous bond mainly composed of the overlying soft parts. Still, this condition, after repair, does not make active extension impossible; in a case of rotation of the upper fragment, as shown in a skiagram, active extension was complete.

A fibro-periosteal fringe is almost constant; it is usually narrow, and does not extend over the whole width of the fragment. That it is not always able to prevent close union is shown by the good results of many operations by methods which do not remove it. On the other hand, the long strips of fascia, which are sometimes torn from the lateral regions below the joint and drawn up into the gap, appear to be a serious bar to union, and their presence is wholly unrecognizable except through an incision, but they appear to be most frequent in the cases in which the primary separation is great.

Marked distention of the joint by blood and exudate is the principal factor in maintaining separation of the fragments; indeed, it is the only one which in a recent case can prevent their approximation by the fingers when the joint is in full extension. The agency of the quadriceps in this separation has, I think, been greatly over-estimated; I have repeatedly observed, when the fracture has been exposed by incision, that active contraction of the muscle did not separate the fragments more than a quarter of an inch if the foot was held a few inches above the bed. Later in the case, however, the gradual retraction of the muscle and of the ligamentum patellæ may create an interval which cannot be closed by any permissible amount of traction.

Considering next the course of the case and the ultimate results, as they bear upon the question of treatment, we find that if the fragments are kept fairly well together, and if neither is tilted, a fibrous bond forms between them, which may ossify wholly or in part if the contact is very exact, but which in cases not treated by operation almost always remains fibrous, and usually lengthens somewhat under use during the first few months. Most of the skiagrams I have taken have shown bony union only in the posterior half or three-fourths. Some of them also show an angular displacement, producing a slight concavity of the articular surface, which has been thought to favor full restoration of function. If the fragments are not kept together, or if one is turned so that its fractured surface is directed forward or backward, the union between them is by a bond formed mainly by the overlying soft parts, but sometimes by a thicker one apparently of new formation; it seems probable that the latter is produced by the elongation of a shorter bond formed under favorable conditions of proximity and position.

Hypertrophy of the fragments is frequently noticed, and sometimes appears mechanically to limit flexion of the knee.

On the first attempts to use the limb the joint is found to be very stiff, but usually the range increases quite rapidly and full active flexion and extension are ultimately re-estab-

lished. In a certain, not large, proportion of cases there is notable loss of function: either inability fully to flex or almost complete loss of active extension, although the joint is freely movable, or inability to make complete active extension.

These disabilities coincide with and presumably depend upon the varying conditions of the fragments and uniting bond which have been described.

Inability to flex appears to be largely due to retraction of the portion of capsule attached to the upper fragment and of the fascia lata on the outer side, and sometimes to enlargement of the patella, itself the result of hypertrophy of the fragments or of a short, stiff bond between them, which makes the bone too long to turn over the curve of the condyles. This retraction of the capsule is presumably the result of cicatrization along its torn edge.

Loss of active extension, when marked and when combined with free flexion, is due to insufficient union between the fragments and the absence of supplementary fascial connections between the quadriceps and the leg, such as are found in some cases. It is remarkable that this loss interferes so slightly with ordinary use of the limb; the patients often walk easily and securely, although they are exposed to fall whenever their weight rests only on the partly flexed limb. There is difficulty in going up and down stairs and in rising from a seat. The common defect on this side is slight limitation of active extension, the patient being unable to raise the foot from the bed without first slightly flexing the knee.

The obstacles to close apposition of the fragments and their close reunion, then, are the distention of the joint, the interposition of the fibro-periosteal fringe or aponeurotic shreds, and to some extent the pull of the quadriceps and the tension of the fascia lata. Later causes of limitation of function are adhesions and retraction of the soft parts of the joint, hypertrophy of the fragments with firm union between them, and possibly degeneration of the quadriceps.

The numerous methods of treatment, which respectively

aim more or less specifically to remove one or another obstacle or late consequence, may be grouped as operative and non-operative, including in the former those in which the fragments are mechanically fastened together either after open arthrotomy or by means introduced subcutaneously or acting temporarily or permanently through the punctured skin,—in short, those which distinctly involve the chance of infection of the joint.

The points to be considered in choosing between these two main methods are that a long experience has shown that non-operative methods furnish in the great majority of cases in which they are properly used a result which is functionally satisfactory, even if the union of the fragments is not close; that most of the failures are apparently due to unfitness of the method chosen or its faulty use; that only in a small proportion of cases are the conditions such as to make a bad result inevitable without resort to operative methods, and that most of the later causes of limitation of function are equally active after either method of treatment. That direct mechanical approximation and maintenance of the fragments, if the dangers of the operation are escaped, practically annuls or insures the removal of the primary obstacles in all cases, notably hastens the restoration of function, and probably makes that restoration more complete in some cases, besides making it possible in those in which otherwise it would certainly fail to be obtained cannot be denied. On the other hand, operation exposes to infection; and if infection occurs the result is almost certain to be a stiff joint, amputation, or death. In short, it takes less time and makes a good result more certain, but some of its failures are disastrous to an extent far beyond that of non-operative failures.

If there was no risk in an open operation it would deserve selection in almost every case, if only because it makes possible the removal of those certain causes of failure which are sometimes present and cannot otherwise be recognized and removed, such as tilting of the fragments and the interposition of bundles of fascia. The propriety of resort to

operation turns therefore, in the absence of special reasons, upon the measure of safety with which it can be done; and while I believe that certain methods, when surrounded by every precaution, can be employed with an assurance of success that justifies resort to them, and while I habitually use them, yet I have never taught them as routine practice, but, on the contrary, have strongly advised against their use except by those who can bring to them not merely experience in operating but also the *habit* of taking surgical precautions and the aid of trained assistants who have the same habit, who are practising those precautions daily,—in short, the *personnel* of an active surgical hospital service. I do not mean that any one of the many operative methods proposed and used can be done with this assurance of success, but only that the one with which I am familiar, and which I have now used in more than seventy cases without accident, can be so done, and that only because it is, in my judgment, freer than most operations from those more or less unavoidable causes to which we attribute our disasters. I refer especially to the difficulty of making the hands clean. The general practitioner, and even the occasional surgeon, is not only fully justified in using a non-operative method but ought to do so; and he can feel assured that the methods at his command justify the expectation of a satisfactory, even if not perfect, result.

Of non-operative treatment it is sufficient here to say that the effusion may be removed by the pressure of an elastic bandage, maintained for a few days or even for a fortnight if it keeps the fragments close together; then the limb is placed upon a posterior splint and bandaged from the foot to the upper part of the thigh, the turns immediately above and below the fragments being placed obliquely so as to press them somewhat together; and the patient is kept in bed, on his back with the foot raised, for a month or six weeks. Then the limb is encased in plaster, and the patient allowed to go about on crutches. After another month the splint may be left off at night, and the patient encouraged to move the joint.

A few methods, which may be termed intermediate, need mention before the operative methods are considered. They are intended to act directly upon the fragments without involving the joint, but as they require multiple punctures of the skin which must be kept open for several weeks, and as these punctures may communicate with the seat of fracture through the spaces created by the extravasated blood, the chance of infection exists. Malgaigne's hooks are the earliest of these, and their principle is found not only in the various modifications which have been made, but also in others which differ widely in form, such as Robson's and Anderson's.

Mayo-Robson (*British Medical Journal*, March 30, 1889) passed a pin transversely through the tendon of the quadriceps close to the upper edge of the patella, and another through the ligamentum patellæ close to the lower edge, and then drew the fragments together by a ligature about the projecting portions of the pins on each side. Dieffenbach had long before driven pegs into the fragments and tied them together.

Anderson (*Lancet*, July 2, 1892) modified Robson's method by passing the pins through the fibro-periosteal covering of the fragments, a disadvantageous change, I should think, because it brings the punctures nearer the fracture and thereby increases the chance of infection of the joint in case suppuration should take place about the pins, as it did in one of his four cases.

Operative treatment, in which the joint is directly opened or entered, began<sup>1</sup> with Lister's wiring of the fragments; it presents a great number of methods and procedures, some of which are a natural evolution from their predecessors in the direction of simplicity, efficiency, or safety, while others are merely novelties obtained at the price of some disadvantage or based upon the exaggeration of the importance of some indication. The fundamental idea is the mechanical fixation of the fragments by some form of suture,

<sup>1</sup> In 1834 Dr. Barton, of Philadelphia, fastened the fragments together by a wire passed and tied outside the skin; the patient died.

and the associated one is either the removal of the effusion or of the periosteal fringe, or the reduction of the risk by the use of punctures instead of a free incision. Their comparison will be made easier by first considering certain facts and general principles.

The pull of the quadriceps, when the knee is fully extended and the hip slightly flexed, is so weak that even when the muscle is actively contracted it will not separate the fragments more than half an inch. I have repeatedly observed this during an open arthrotomy, and I have seen several patients pass through an attack of delirium tremens in the first week without tearing apart the fragments, although they were fastened together only by catgut or light silk sutures. It is plain, therefore, that a strong suture, one of metal or heavy silk, is not necessary to the proper approximation of the fragments if the joint is not distended and if the foot is kept elevated. Consequently, any additional risk or complexity of procedure involved in the use of a strong suture is not justified. This, in my opinion, is sufficient for the rejection of all methods of suturing which require drilling of the bone, even without consideration of the disadvantages which pertain to the permanent presence of a foreign body in the bone or soft parts.

The early removal of the effusion facilitates approximation and probably diminishes the chance of the formation of adhesions and periarticular thickening and retraction. Other things being equal, therefore, methods which include such removal are preferable to those which do not, and if they also permit the adjustment of an interposed periosteal fringe or aponeurotic shred they have an additional advantage.

The periosteal fringe, long charged with much of the responsibility for failure of bony or close fibrous union, has been shown by large experience with operative methods in which it was disregarded to be usually a negligible factor,—that is, long series of cases treated by subcutaneous suture have given close union in almost all, and yet it must be believed that a fringe of some size was present in most of them.



On the other hand, I think the large aponeurotic shreds which I have seen several times would probably have been a serious obstacle if they had been left, and possibly similar ones have been responsible for some of the failures noted under methods of treatment usually efficient. It is, therefore, not necessary to choose an open method in order to adjust the fringe, but probably in a small proportion of cases there is present a fringe or shred of such size that it will diminish the success of any operation which does not effect its removal. Again, other things being equal, an open method better protects against this obstacle to success.

Infection may occur in any operation which wounds the skin, and the chance of its spread to the joint—the great danger—is greater if that wound communicates with the joint or the seat of fracture. The briefer the existence of that wound or of that connection, the less the danger. All the so-called subcutaneous methods require two or more small incisions, and in all a suture of silk or wire is passed either directly into the joint or through the line of fracture or its immediate neighborhood. If suppuration occurs at a puncture, the suture opens a direct road for its spread to the joint. The size of the wound is not a measure of the chance of infection; that comes, if the common precautions are taken, mainly from the hands of the operator and his assistants.

Finally, the permanent presence of a foreign body in the tissues is not, according to general experience, a matter of indifference; occasionally suppuration takes place about it after a long interval, and not infrequently its removal has been required because of pain and irritation.

The operative methods are: (1) by open incision,—direct suture of the fragments through holes drilled in them, suture of the fibro-periosteal layer, and mediate suture through the tendon of the quadriceps and the ligamentum patellæ; (2) subcutaneous suture,—by wire through the whole length of the fragments, or by silk through the tendons and crossing the front of the bone; (3) subcutaneous perma-



nent ligature surrounding the fragments in the sagittal plane and lying partly in the joint; (4) temporary ligatures passing through the joint as in 3, or through the tendons as in 2, or through the bone, and tied outside the skin.

The methods are far too numerous to permit a detailed description and criticism, even if it were not probable that most of them will be abandoned in favor of the simpler and safer ones. Many of them, too, can be judged in classes. Thus, for reasons already given, I would reject all in which a permanent suture is placed in the bone itself.

Temporary ligature through the tendons (one of the earliest methods proposed) or through the bone, or around it through the joint, seems to me to be more dangerous, because of the prolonged communication with the exterior, and less efficient than the similar subcutaneous methods.

The subcutaneous methods, which can be done equally well by an open incision, appear to have an equal risk with and to lack the advantages which belong to the latter.

Barker's subcutaneous ligature about the fragments (silver or silk passing through the joint) opens a direct road for the spread to the joint of infection occurring at either puncture or about the ligature, and as it also fails to provide for satisfactory evacuation of the joint and adjustment of the periosteal fringe I should reject it. It appears to have met with some favor and success, however, since its introduction in 1894, and has been commended by several.

My personal experience is limited to the subcutaneous mediate silk suture through the tendon and the ligamentum patellæ (1889-1892, about forty cases), and open incision with the same or the fibro-periosteal suture (1892-1898, about seventy cases). In the first series infection occurred twice, and resulted in a stiff joint, suppuration appearing in one of them after the patient had left the hospital, apparently well, in the second week. In the second series all the cases have recovered without accident and with close union; but I should add that I know of two cases treated by others in which suppuration occurred. All the patients I have seen

after the third month have had good use of the joint except one stout, nervous woman, who could not be persuaded to abandon crutches; her patella was freely movable laterally and the union was close, but flexion was limited to 30 degrees three months after the accident.

I began with the subcutaneous suture because I thought its risks less than those of free incision, but when I found that the extravasated blood often escaped freely through some of the four small incisions and that consequently the suture lay freely within the area of fracture and laceration I abandoned it for the single free incision, and was soon convinced that the patient was equally, perhaps better, protected. A special advantage is that the operation can be done without once touching the cut tissues with the fingers, and to that I attribute the complete freedom from infection. I have frequently done the operation under local anæsthesia,—cocaine or freezing.

The method is as follows: An incision is made in the median line slightly overlapping both fragments; the sides are drawn apart, the fragments lifted in turn with a sharp retractor, and their surfaces freed from clot or fringe; while they are held up the joint is thoroughly washed with a hot salt solution. Then the fragments are drawn snugly together with hooks, the fringe adjusted, and two or three catgut sutures placed in the periosteum along the edge of the fracture, or a single silk or stout catgut suture passed through the tendon and the ligamentum patellæ so that its two strands lie on the front of the bone. Sometimes additional sutures are placed in the rents in the lateral expansions. The incision is closed, without drainage, with a continuous silk suture, the dressing applied, and the limb bound upon a posterior splint. The patient is kept in bed with the foot elevated for a week, the silk suture of the incision is then removed, and a light plaster-of-Paris encasement applied. After a few days he leaves the hospital on crutches, and after a month the dressing is cut down in front, and he is directed to wear it only in the daytime. Usually the joint can be

flexed at least 90 degrees by the end of the third month, often earlier, and the patient usually discards the splint entirely before that time, for he is told it serves only as a precaution against damage by a fall. In no case have I seen the fragments separate under use, but several have come back in the third or fourth month with refracture caused by a fall.

I have treated a few cases without immobilization after the tenth day, but the gain in rapidity of restoration of function has not been enough to justify the risk of accident.

For Ceci's method (first subcutaneous wire suture through bone) see *Deutsche Zeitschrift für Chirurgie*, February, 1888; Aitkin's modification, the wire passing only once through the bone and then back under the skin, *British Medical Journal*, July 23, 1892; Barker's method, subcutaneous ligature through the joint about the patella, *Lancet*, April 18, 1896; subcutaneous mediate suture through the tendon and ligamentum, Stimson in *New York Medical Journal*, May 10, 1890, p. 531. Other plans not above mentioned are those of Wolff (*Deutsche medicinische Wochenschrift*, May 14, 1891), open incision, two metal rivets driven into each fragment to receive silver wires by which the fragments are fastened together; Kittredge (*Boston Medical and Surgical Journal*, November 19, 1891), two similar rivets placed astride the line of fracture; and Axford (*ANNALS OF SURGERY*, July, 1888), temporary wire suture through the bone and back outside the skin. Other older temporary measures are Barton's in 1834 (the same as Axford's), Volkmann's silk loops transversely through the tendon and ligamentum patellæ and tied together over the skin, and Kocher's (1880) surrounding wire ligature, passing, like Barker's, beneath the patella, but, unlike his, including the skin in its loop.

Finally, a word as to the treatment of old fractures with diminution of function. Attention has been so fixed upon the need of maintaining approximation of the fragments in recent fractures that we have naturally been inclined to assume that a similar approximation would be required to relieve later disability associated with the presence of a gap

between the fragments, and our efforts have been almost exclusively given to closing that gap. The results have been far from satisfactory. The obstacles in the way of even an operative success are often insuperable, and even when the gap has been closed the disability has persisted. The reason is to be found in the facts already given: the principal cause of disability is the opposition to the descent of the upper fragment produced by the retraction of the lateral and upper portions of the capsule attached to it, not the absence of close union between the fragments, although undoubtedly the latter is the sole factor in some cases. The most troublesome disability is the loss of flexion, not that of active extension; and the ability fully to extend may exist even when the gap is wide.

The remedy, then, is to make flexion possible, and that can only be done by so liberating the capsule that it will be long enough to permit the descent of the upper fragment, or to produce the equivalent condition by extirpation of that fragment. It is known that partial or total loss of the patella does not involve loss of function; the quadriceps retains control of the leg through its fibrous and fascial connections, and surely in such a case as that, in which full active extension exists, although the upper fragment is rotated 90 degrees and separated from the lower by more than an inch, its removal would be unlikely to diminish that power; probably, too, it would increase the flexion, which now is only about 40 degrees, because it would produce a relative lengthening and relaxation of the capsule which now checks the descent of the fragment. The removal could be easily effected subperiosteally without destroying the continuity of the connection between the quadriceps and the lower fragment. I believe this would be a safer and more efficient means of meeting the indications in most cases than those heretofore employed. It has been practised in one case with a good result by Chaput (*La Semaine Médicale*, June 17, 1891).





Case I before operation.

REPORT OF TWO CASES OF INJURY TO THE  
THORACIC DUCT IN OPERATIONS  
ON THE NECK.

By DRS. W. E. SCHROEDER AND S. C. PLUMMER,

OF CHICAGO,

CLINICAL ASSISTANTS TO PROFESSOR C. FENGER, NORTHWESTERN  
UNIVERSITY MEDICAL SCHOOL.

CASE I.—Gus Ewing, colored; aged twenty-four years; male. In the winter of 1895-96 he noticed on each side of his neck, at about the middle, small, hard, painless tumors, superficially seated. These have slowly increased in size and grown softer. They have never been painful. As a result, on admission, there is on each side of the neck a large, ovoid, fluctuating tumor, extending upward from the clavicle and filling the supraclavicular fossa. (See Fig.) There is such a correspondence in the size and shape of the two tumors that the neck appears almost bilaterally symmetrical. Skin over tumors normal in color, somewhat tense, but freely movable in all directions. Tumors cannot be moved from side to side nor vertically. The tumors are not compressible, nor do they pulsate. On the right side no enlarged glands can be felt, but on the left side several are palpable. Aspiration gave a sero-purulent fluid from both sides. From this fluid an attempt was made to cultivate bacteria on glycerine-agar, agar-agar, and bouillon, with negative results. The fluid was examined microscopically, and showed fatty, degenerated, broken-up cells and white cells in great quantities; no epithelial cells; no cholesterin crystals.

*Operations.*—The mass from the right side of the neck was first attacked and removed without accident, although its deeper surface was found to be attached to the cervical reflection of the pleura and to the subclavian vessels.

After cicatrization of the operative wounds left by the first

operation had been secured, the left side was operated upon by Drs. Schroeder and Plummer. The posterior and upper borders of the mass were detached with ease, as well as the portions of the deep surface adjacent to them. The remaining portions of the tumor were firmly attached to the *scaleni* muscles and the apex of the pleura, the lower anterior portion of the tumor extending forward under the sterno-cleido-mastoid muscle.

The clavicular head of the sterno-cleido-mastoid muscle and the omo-hyoid tendon were cut. It was then seen that, in addition to the large cystic tumor, there were intimately connected with it at its anterior inferior angle, two glands each about two and a half centimetres in diameter.

These pushed the internal jugular vein far forward towards the median line. The greater portion of the sternal head of the sterno-cleido-mastoid muscle was now cut through. By blunt dissection the upper and posterior portions of the deep surface were separated to a considerable extent.

As the lower anterior portion was being bluntly dissected, the internal jugular vein was found to be spread out flat, like a ribbon, over the anterior inferior medial angle of the tumor mass, bending outward at this location to reach its normal position behind the clavicle. What appeared to be a portion of fascia was pulled away from the tumor, and there followed immediately a sound of suction of air and a rush of venous blood. The vein had been torn open. The bleeding point was immediately compressed and then seized by artery forceps. A slight air embolism had occurred, but it took place during one inspiration only, and produced no noticeable symptoms. The hæmorrhage being checked, a transparent, yellowish, serous discharge was seen in the wound, which, on examination, was seen to come from a small orifice, evidently an opening in a large lymphatic vessel, either the thoracic duct itself or its large subclavian branch.<sup>1</sup> This was seized with an artery forceps. Further operating in this locality was for the present impossible. The large cyst was now incised, and from it escaped a thick, creamy, purulent material.

With scissors the portion of the cyst wall which had been separated from surrounding tissues was removed, leaving a portion below and behind about three centimetres square. At the

<sup>1</sup> See diagram, *ANNALS OF SURGERY*, Vol. xxiii, p. 584, May, 1896.



lower medial portion the cyst wall was firmly attached to the two enlarged glands. It was now found possible to detach these from the internal jugular vein and other attachments, and they were removed along with the main portion of the cyst wall. An attempt at lateral ligation of the internal jugular vein proving unsuccessful, an aneurism-needle was passed around it and the vein, ligated above and below the opening in it. A ligature was now put around the hole in the torn lymphatic vessel, but upon removing the forceps the discharge of transparent, yellowish fluid began from a point just beyond, towards the median line. Four times a new rent was ligated, only to be followed by a fresh discharge of between one and two cubic centimetres of fluid. Evidently the openings were in the side of the vessel, which kept giving way. All this time no distinct vessel could be found; we could see only an orifice, about one and a half millimetres in diameter, discharging fluid. As the operation had been a long one, and the patient's condition was getting bad, the attempt to stop the orifice by ligation was abandoned. From the horizontal direction of the vessel it was taken to be most probably the large subclavian branch of the thoracic duct.<sup>1</sup>

Two or three additional glands, slightly enlarged, were removed. The small portion of the cyst wall remaining was now curetted. The whole wound was swabbed with tincture of iodine, and then dashed with a solution of iodoform in ether. The omohyoid muscle was reunited, and each head of the sterno-cleido-mastoid was also reunited by quilted sutures. The wound was packed deeply with iodoform gauze. The transverse incisions were united with continuous sutures. The longitudinal incision was united over iodoform gauze packing by sutures left long and tied in bow-knots. Twisted silk was used for all ligatures and sutures. A large gauze and "combination" dressing was applied. Four hours later an enormous serous discharge had taken place, saturating not only the large dressing but also the pillow and bedding.

The third day after the operation the gauze packing was removed. The wound appeared aseptic. A small packing of

<sup>1</sup> It is necessary to state that Professor Fenger's practice in such a case would be to seize the leaking vessel with an artery forceps, which would be allowed to remain for forty-eight hours, rather than to rely on tamponing, as was done in this case.

iodoform gauze was introduced; a smaller external dressing was applied.

During the following three weeks the discharge gradually diminished in amount and became purulent. During the later history the wound contracted to a small sinus, from which one-half ounce of thick, light-colored pus at lower end of longitudinal incision occurred.

When the patient was last seen, three months later, there exuded a discharge so slight that for periods of two successive days a crust would close the exit. The patient then left the city and was lost track of.

CASE II.—Mrs. G., aged twenty-three years, presented herself with a mass of tubercular glands on the left side of the neck, which pushed the sterno-cleido-mastoid forward and inward. The skin over this swelling was normal and movable, excepting at the location of a former sinus where there was a scar. No sinuses are to be seen at the present time. The patient was subjected to the following operation, which is Professor Fenger's usual method of operating in cases of tubercular glands of the neck:

The usual antiseptic precautions having been observed, and the patient's shoulders and neck having been somewhat elevated by an air-pillow or folded sheet placed under them; an incision was made along the entire length of the sterno-cleido-mastoid muscle, from the posterior border of the mastoid process to a point one inch below the sterno-clavicular articulation, the incision corresponding in direction with that of the fibres of the muscle, lying midway between the anterior and posterior borders of the muscle, and, in its lower part, crossing the cellular interval between the sternal and clavicular heads. The first cut extends through the skin and superficial fascia only, crossing the external jugular vein, which is now exposed by cutting through the overlying platysma muscle, seized by two artery forceps, cut in two, and ligated at each end. The skin with the superficial fascia and platysma is now retracted, and the whole posterior border of the sterno-cleido-mastoid freed by blunt dissection. Still further retracting these superficial structures, they are dissected from the underlying structures until the field of operation is sufficiently exposed. The interval between the clavicular and sternal heads of the sterno-cleido-mastoid is now exposed, the clavicular head

is raised from the underlying structures, and cut through on a director near the place where the two heads join. The omohyoid muscle is now transfixed with two rather heavy silk sutures, and divided between them, the sutures being left long and serving, at the close of the operation, as aids for locating the muscle, which retracts strongly, and drawing its divided ends together.

By these procedures the internal jugular vein has been exposed and is seen filling and emptying with each respiratory movement. The lowest available portion of the vein is now carefully isolated by blunt dissection, and an aneurism-needle, armed with heavy silk, passed around it, especial care being taken not to include the pneumogastric nerve with the vein. The needle being withdrawn, the vein is now provisionally ligated by tying a large bow-knot. The object of this provisional ligature is to prevent respiratory movement in the vein and to prevent air embolism in case of injury to the vein. Sometimes the provisional ligation of the internal jugular vein is performed as an earlier step in the operation,—that is, before the division of the clavicular head of the sterno-cleido-mastoid muscle, by entering the cellular interval between the two heads of the muscle. This ligature is removed at the close of the operation, if the vein has escaped intact; otherwise the bow-knot is changed into a reef-knot and allowed to remain, the vein being also ligated above the point of injury.

The removal of the glands is now begun from below upward. This is accomplished by blunt dissection as far as possible, but frequently, owing to old periadenitis, the adhesions are too dense to be separated except by the use of scissors and knife. The separation of the glands from the vein is often extremely difficult, they being closely adherent to the vein throughout the greater portion of its length, so as to necessitate constant cutting immediately along the vessel. Oftentimes, even when the vein itself escapes laceration, branches of it are severed so closely to the vein as to require lateral ligation of that vessel with silk, which procedure is also practised in case of a moderate laceration of the vessel itself. Frequently glands are found beneath the vein and also at times in front of it. In one case the whole circumference of the vessel was surrounded by glands matted together by dense connective tissue, making their re-

removal impossible without removal of a portion of the vein, which was consequently ligated above, the provisional ligature below being made a permanent one. Dr. Fenger has never seen any untoward results indicating circulatory disturbance after this ligation of both external and internal jugular veins on one side. The carotid vessels, especially the common and internal carotid arteries, are also exposed during the operation, but not so extensively as the vein.

In approaching the junction of the upper and lower halves of the neck, as the dissection progresses upward, a strict lookout is kept for the branch to the trapezius of the spinal portion of the spinal accessory nerve, which emerges from the posterior border of the sterno-cleido-mastoid and passes obliquely downward and backward. The nerve can be identified by pinching it with a forceps, which causes elevation of the shoulder through contraction of the trapezius muscle. When found, the nerve is isolated throughout the portion of its course between its exit from the posterior border of the sterno-cleido-mastoid and its entrance into the trapezius, and a loop of gauze thrown loosely around it, by means of which it is held out of the way. The preservation of the nerve often adds much to the difficulty of the operation, but is always considered worth the time which it requires, because, if it is severed, drooping of the shoulder and inability to raise the arm vertically results. The superficial descending branches of the cervical plexus, being all cutaneous nerves, are not of sufficient importance to warrant time being spent in searching them out. The phrenic nerve, descending on the anterior surface of the scalenus anticus muscle, is often exposed and is carefully preserved.

The quest for affected glands is continued upward to the posterior belly of the digastric muscle, above which it is rare to find tuberculosis of the deep glands. Now follows the removal of the tubercular glands below and anterior to the ear, which glands lie on or are buried in parotid gland tissue along the temporo-maxillary vein, portions of the parotid salivary gland being necessarily removed with the tubercular lymphatic glands, care being taken to preserve the branches of the facial nerve. The angle between the common facial and internal jugular veins and also the submaxillary region are now carefully examined for the presence of enlarged glands, and, if such are

found and cannot be removed through the incision along the sterno-cleido-mastoid, another incision is added, starting on a level with the bifurcation of the common carotid artery, and extending upward and forward towards the chin. The incision is not made so deep as to cut the sterno-cleido-mastoid muscle or the external carotid artery. This incision exposes the lower border of the submaxillary salivary gland, which must be distinguished from lymphatic gland tissue, and the same precaution must be taken when working in the parotid region. The space between the anterior bellies of the two digastric muscles must not be overlooked in the search for affected glands, as there are often found two or more affected glands in the median line anterior to the hyoid bone.

The supraclavicular fossa is next examined, and, if found necessary, another incision is made backward across the subclavian triangle, running at right angles to the first incision, and joining the latter near its lower end. Through this the supraclavicular glands are removed, bearing in mind the location of the brachial plexus and subclavian vessels. It is not uncommon to find the tubercular glands extending low down along the deep surface of the trapezius muscle as far as one to two inches behind its anterior border.

Sometimes, in the course of the operation, there is heard during inspiration a sound caused by the aspiration of air into the connective tissue spaces at the base of the neck. This is at times startlingly similar to the sound of air being aspirated into an open vein, but in these cases an examination of the internal jugular vein will prove the absence of the latter accident. The air can be aspirated down into the anterior mediastinum along the superior vena cava to the space around the pericardium, and the emphysema here can give rise to pain and a feeling of oppression in the region of the heart that may last for several days.

During this time there may be heard by the stethoscope a peculiar, intermittent, crackling sound accompanying the contractions of the heart. In a case observed by Professor Fenger these phenomena disappeared in from four to five days. To prevent the occurrence of this complication a little gauze is packed into the lower part of the wound over the provisional ligature of the internal jugular vein after the removal of the

lowest glands, and allowed to remain till the close of the operation.

In very difficult cases, or where the patient does not stand the operation well, the operation is sometimes done in two sittings, all glands below the isolated branch to the trapezius of the spinal accessory nerve being removed at the first sitting, and the nerve pulled down and anchored by a loop of muscle, cut loose at one end from the sterno-cleido-mastoid, passed over the nerve, and fastened with a suture.

The wound is cleansed with sterilized water, dried with gauze, and its entire surface swabbed with tincture of iodine, after which a solution of iodoform in ether is dashed over it. Drainage by rubber tubes is provided for at the lowest point (with the patient in the recumbent posture) by a special opening. The omo-hyoid muscle is brought together and the clavicular head of the sterno-cleido-mastoid united by a quilted suture of heavy silk. The wound, if it has been an aseptic one, is then united by continued or interrupted sutures. If pus has been present, the wound is packed with iodoform gauze and united by secondary sutures.

In the case of the woman, whose case is the text for this report, while the procedures in the subclavian triangle were being carried out, suddenly a milky fluid flowed freely into the wound, evidently from an injury to the thoracic duct or one of its branches. The opening was found and the vessel lifted up by forceps, when a gurgling sound was heard produced by the aspiration of air into the vessel. Gushes of fluid appeared intermittently with the respiratory movements through a visible slit in the vessel. A silk ligature was placed around the forceps and the vessel was ligated. The wound was carefully sponged and it was noticed that chyle was discharging from two smaller openings, which were also ligated. The wound was treated as usual.

For a few days the patient had a temperature of  $101^{\circ}$  F. and pulse of 95, but there was never any further discharges of chyle, nor did any difficulty arise from the ligation of the chyliferous vessels. The patient has gained in weight since the operation.

## TWO CASES OF RECOVERY FROM TRAUMATIC TETANUS AFTER THE USE OF ANTITOXIN.

By GWILYM G. DAVIS, M.D., M.R.C.S. (ENG.),

OF PHILADELPHIA,

SURGEON TO THE EPISCOPAL, ST. JOSEPH'S, AND ORTHOPEDIC HOSPITALS.

THE impression which I had received from the various accounts of cases of traumatic tetanus treated with antitoxin caused me to form the opinion that its value had not been proven, at all events, when given occasionally and in small doses. The fact that Frederick S. Dennis (*ANNALS OF SURGERY*, December, 1897, p. 657) claimed that this failure was due to its not having been given in large enough doses nor continued sufficiently long caused me to push its administration, both as to amount and length of time, to the extent of my resources.

My experience and observation as to the mortality following the ordinary sedative treatment of traumatic tetanus have been that the disease is almost always fatal, unless decidedly slow and subacute in its onset and course. The recovery of 40 per cent., as given by Lambert, seems to me to be too optimistic, and must have been obtained by a preponderance of very mild cases.

The histories of the two cases are as follows:

CASE I.—Jas. MacD., aged twenty-three years, and a glass-worker by occupation, had been well save an attack of catarrhal jaundice, from which he had recovered three months previously. Two weeks before admission, while cutting a piece of clean wood with a bread-knife, he wounded one of his fingers. While at work he only handled freshly blown glass, and his hands were



ordinarily clean. The knife-blade was somewhat tarnished and rusty, but not especially so. One week later he experienced pain and stiffness of the muscles of his back. Four days later this had involved his neck and jaws. His jaws opened with difficulty and he was unable to take an ordinary mouthful of food. This condition persisting, he applied to the Surgical Dispensary of the Episcopal Hospital, and was thence referred to the house. He was admitted to the wards of the hospital under my care on February 3, one week after the first appearance of symptoms. On admission his temperature was  $99.6^{\circ}$  F., pulse 120, respiration 36. He had pain and stiffness of the muscles of the neck and back. This was most marked in the lumbar region. He could swallow when the food was once well back in the pharynx. His head was slightly drawn back and facial expression peculiar, being as if frightened. The eyes were widely open and the forehead wrinkled with transverse furrows. On talking the corners of the mouth were markedly contracted and upper lip everted. He could only open the jaws about half an inch. His hands were tremulous but he could use them, and he walked stiffly. The wound of the finger was practically healed. On the next day the pain and stiffness persisted, together with the difficulty in swallowing. He complained of pain in the left cheek. He was given three doses of chloral, each of twenty grains.

On the next day, February 5, he received ten cubic centimetres of Roux's tetanus antitoxin hypodermically besides the chloral. He was passing one-third the normal quantity of urine, —non-albuminous. On the 6th there was a slight change for the worse. Increase of pain and stiffness. Swallowing unimproved. Forty cubic centimetres of antitoxin given in addition to the sixty grains of chloral. On the 7th he had a slight spasm, being thrown into opisthotonos by being accidentally touched. Swallowing was unimproved. Five doses or fifty cubic centimetres of antitoxin were given, and the chloral, raised to thirty grains, and bromide of ammonium, thirty grains, were given *t. d.*

On the 8th there was a slight improvement, and swallowing was better. Forty cubic centimetres of antitoxin, besides the chloral and bromide, were given.

On the 9th the improvement still continued, and he was given one dose (ten cubic centimetres) of antitoxin.

On the 10th the improvement continued. Fifty cubic centi-



metres of antitoxin were given. Swallowed milk readily. Thirty ounces of urine passed.

February 11: No antitoxin. February 12: No antitoxin; no change. February 13: No antitoxin. Improvement continues; can now turn on his side. February 14: Twitching of muscles of right side of throat and left side of jaw. Twenty cubic centimetres of antitoxin. February 15: Some increase in pain in the jaw muscles. Slight stiffness of jaw muscles. Twenty cubic centimetres of antitoxin. February 16: Increase of pain in arms and stiffness of arms and throat. February 17: Increase of stiffness and pain in arms, back, and throat. Seven doses of antitoxin, each ten cubic centimetres, administered. Two were given at 8.30 A.M.; two at 1.00 P.M.; two at 7.00 P.M.; and one at 11.00 P.M. February 18: Patient quieter than on day preceding. Thirty cubic centimetres of antitoxin. February 19: Much pain in feet and legs; somewhat delirious; no antitoxin. One-third of a grain of the extract of calabar bean was given instead of the bromide. The chloral was continued.

February 20: Still delirious; slept more.

February 21: Complains of pain in hands and fingers, also at site of original wound (now healed). Delirious at intervals. Three doses of antitoxin.

February 22: Still slightly delirious, again tried to get out of bed. Marked pains in palms of hands. Last night most quiet of any. Takes nourishment readily. Two doses of antitoxin.

February 23: Sleeps soundly. Most of his pains are gone; no longer delirious; temperature dropping and allowed to eat solid food.

February 24: Has lost the drawn appearance of his face; mouth opens readily and he eats chicken and eggs, etc. No more antitoxin, but chloral still continued. From this on convalescence was rapid. His temperature for the first ten days, after admission, went from 97° to 100.4° F. On the tenth day his temperature was 99°, for the next eight days it ranged from 100° to 103°, and then came down to 99°; then later went to 101°, but in five days it was down to normal.

CASE II.—J. K., aged thirty-five years, a teamster, had had average good health until three weeks previous to admission. At that time he had injured one of his fingers by a falling stone while unloading his wagon. He wrapped some rags around the

finger, and continued at his work for the following two weeks. He was then suddenly seized with cramp-like pains in the abdomen and the back, whence they rapidly extended to the back of the neck. Three days later there was marked difficulty in opening the jaws and in swallowing food. He shortly had spasms of the back producing opisthotonos. They were said to occur frequently.

On admission, at 10.00 P.M., February 10, a small unhealed wound was found on one of his fingers. Temperature was 100.2° F., pulse 76, respiration 24. Opisthotonos was caused by any slight disturbance. He was hardly able to swallow. The jaws could scarcely be opened half way, eyes half open, corners of mouth retracted, arms very stiff, and complains of continuous pains in the muscles along the entire spinal column, also in those of the abdomen. Three doses of antitoxin (thirty cubic centimetres in all) were injected twenty minutes after admission. He was also given thirty grains each of chloral and bromide of ammonium. This was continued daily.

On February 11, the second day, he was slightly improved. Vomited at frequent intervals, had numerous spasms, and was given ten cubic centimetres of antitoxin.

Third day: Spasms averaged five to six per hour and even went to eight. Thrown from bed by the spasms. Vomits frequently and swallowed a little fluid with great difficulty. No antitoxin.

Fourth day: Five to six spasms per hour, some lasting five minutes; still vomiting. No antitoxin.

February 14, fifth day: Delirious at times; spasms average three per hour. Six doses of antitoxin, each ten cubic centimetres. Spasms increased in frequency until midnight, after which he slept for a while.

Sixth day: Spasms increased again up until midnight and then decreased towards morning. Still delirious. Six doses of antitoxin.

Seventh day: No vomiting; muttering delirium; swallows more readily; extremities now bend readily; still complains of pain in the back. He turned over on his side during the night and slept at intervals. Three doses of antitoxin.

Eighth day: Spasms less; still has muttering delirium; no

rigidity of extremities. Can hold the feeding cup and retains his food and medicine. Three doses of antitoxin.

Ninth day: Again turned on his side, but also again thrown from bed by a violent spasm. Three doses of antitoxin.

February 19, tenth day: Lies in a semiconscious state and complains bitterly if touched. Sleeps, however, if undisturbed. He rouses at intervals and groans. Had fifteen spasms during the preceding night. Was tied in bed to prevent his falling out. No vomiting. Delirious at times. No antitoxin. Chloral, thirty grains and extract of calabar bean, one-third grain, *t. d.* Three slight convulsions during the day.

Eleventh day: Had several spasms during the night, but none during the day. No antitoxin.

Twelfth day: Still delirious; two spasms during the night and two during the day. Three doses of antitoxin. Chloral and calabar bean as before.

Thirteenth day: Three spasms during the night; somewhat delirious at times; no vomiting; takes nourishment readily; sleeps considerably. Now able to turn about in bed at will. One dose of antitoxin and chloral and calabar bean, *t. d.*

Fourteenth day: Three slight spasms during the night; mouth opens widely. Now eats freely of soft food and is able to control bladder and rectum. Still a little flighty when suddenly awakened. No antitoxin.

Fifteenth day: No spasms.

Sixteenth day: Gets out of bed at will and sits up. Later he was discharged cured.

His temperature during the first week after admission ranged from 98.5° to 101° F., after which it remained nearly normal with occasional variations.

The wound of the finger healed a few days after admission.

It will be observed that the antitoxin was given very irregularly; this was due to the difficulties in obtaining the serum.

The antitoxin was that of Roux, and came from Paris in small bottles, holding ten cubic centimetres. They cost \$1.50 each. The first case received forty-two doses in eighteen days. The second case received twenty-eight doses in

twelve days. The question of diagnosis may be suggested. Of this I think there can be no reasonable doubt. The contracted facial expression, stiff neck, locked (partially) jaws, and convulsions (although the first case only had one) were pathognomonic. The main interest in these cases is, what evidence do they afford as to the value of antitoxin. In weighing the evidence, it may be said that sedative drugs were used in addition to the antitoxin. To my mind this does not destroy the value of the evidence for antitoxin. I firmly expected to see both of these cases die in about a week's time, as had nearly all others I had seen, in spite of the use of large doses of the same drugs as were used here. I believe the chloral, bromide, and calabar bean deadened sensation, rendered the patient less susceptible to disturbance, and promoted rest, but that they alone would have saved the patients is questionable. The greatest doubt that arises is that they may have been cases not of the most violent type. They both followed injuries. In the first case symptoms arose one week after its reception, and had not progressed further during the next week except having pain in the cheek, throat, back, and neck, with contraction of the facial muscles, difficulty in swallowing, inability to fully open the mouth (could only open about half an inch), and a slightly staggering gait. Many cases in the same time would have been having convulsions or perhaps have been dead. Still any surgeon seeing him would have thought that he promised trouble. The second case came into the hospital having three to eight spasms per hour, and it was with many misgivings that I decided on administering the antitoxin, on account of its expensiveness. His injury had been received three weeks prior to admission, and he too had had symptoms present for one week before presenting himself. That he was not a case of the worst sort was shown by the fact of his being alive at the end of a week's time, but having as high as eight spasms an hour, and hard enough to throw him out of bed, is evidence that the case was no mild one. In the *ANNALS OF SURGERY* of February, 1898, p. 228, is a report before the Phila-

delphia Academy of Surgery of several cases of tetanus treated by antitoxin with no recoveries. Perhaps the difference, both in the amount used and the kind employed, may account for the difference in results.

At all events, the fact remains that these two cases recovered. The impression with me is that the antitoxin did help them, but it is only an impression, not proof. It is sufficiently firm, however, to cause me to endeavor to follow the same line of treatment in future cases. I feel under great obligations to the management of the hospital for their generosity in allowing me to use considerably over a hundred dollars' worth of antitoxin, when its therapeutic value was so problematical. To my resident, Dr. Cleaver, I am indebted for his careful records and attention to the cases.

## TRANSACTIONS OF THE NEW YORK SURGICAL SOCIETY.

*Stated Meeting, March 23, 1898.*

The President, ANDREW J. MCCOSH, M.D., in the Chair.

### A CASE OF RECURRENT, INOPERABLE SPINDLE-CELLLED SARCOMA OF THE PAROTID SUCCESSFULLY TREATED WITH THE MIXED TOXINES OF ERYSIPELAS AND BACILLUS PRODIGIOSUS.

DR. WILLIAM B. COLEY presented a patient, W. L., aged forty years. His aunt died of a malignant tumor of the breast, which developed after an injury. In September, 1896, he received a slight blow in the left parotid region. Early in 1897 a swelling developed, grew rather rapidly, and was removed by operation in March, 1897. The growth quickly recurred, and in April, 1897, a second and third operation was performed at the Bridgeport Hospital by Dr. T. W. Wright, the attending surgeon. It was found impossible to remove the entire tumor, and the glands in the neck had already become involved. The tumor was examined by Dr. Ellis, the pathologist to the hospital, and was pronounced spindle-celled sarcoma. The tumor grew very fast, and inasmuch as it was clearly inoperable, the question of treatment with the mixed toxines was considered, and Dr. Coley's opinion was asked by letter. He advised a trial of them for three or four weeks, stating that unless improvement occurred by the end of that time he would discontinue the treatment. A fresh bottle of the toxines was obtained of Dr. B. H. Buxton, at the Loomis Laboratory, and treatment was begun at the Bridgeport Hospital. At the end of three weeks' treatment there was no material improvement in the condition, though there had been some softening and sloughing in the region of the ulcerated or central portion of the tumor. The

patient was sent to Dr. Coley for examination and further advice, on August 9, 1897, with a rather discouraging letter from the house surgeon as to the results of the treatment. Physical examination showed a tumor occupying the entire left parotid region, and extending from the tragus of the ear forward nearly to the angle of the mouth, and from the angle of the jaw nearly to the orbit. The tumor was markedly protuberant, was ulcerated in central portion over an irregular area of one inch in diameter. There was a cicatrix, four inches long, extending from angle of jaw upward to a level with upper border of ear, and a second one in neck parallel with anterior border of sternomastoid muscle. The tumor was hard in consistence and firmly fixed to the deep structures. A second tumor, the size of an English walnut, was situated in the neck just beneath the angle of jaw. The case was absolutely beyond operation, and had not the diagnosis of *spindle-celled* sarcoma been made and confirmed by microscopic examination, Dr. Coley certainly would have advised against further treatment, and regarded the case as entirely hopeless, even from the toxines, but inasmuch as in about one-half of the cases of inoperable spindle-celled sarcoma that he has treated with the toxines the tumors have disappeared, he felt it wise to give him a further trial. He entered the Post-Graduate Hospital August 9, and the injections of the mixed unfiltered toxines were at once begun, since his general condition was nearly perfect. The dosage was pushed much beyond what many patients would have been able to endure, five to eight minims of the strongest solution would usually produce a severe chill and a temperature reaction of  $103^{\circ}$  to  $105^{\circ}$  F. The temperature quickly fell to normal, and the patient was able to be up and about the ward, except during and for a short time following the chill. His appetite continued good and he went out of doors for a walk nearly every day. After about two weeks of treatment there was a slight but unmistakable improvement noted. The tumor became more movable. It lost much of its vascularity, becoming more of a dull blue color, the central or ulcerated portion showed necrobiosis in sloughing. The tumor of the neck was distinctly smaller in size. The improvement thus far was no greater than had frequently been observed in round-celled sarcoma, and which often proved merely temporary; but in this case it continued steadily though

slowly. At the end of six weeks the tumor was less than one-half the size when Dr. Coley first saw him. He was allowed to leave the hospital for ten days to attend to some family matters, and when he returned the condition was about the same as when he left. The injections were again begun, and, as before, pushed to the limit. In spite of this he lost no weight, but seemed to gain in looks and strength. The tumor slowly and steadily diminished, the central portion by sloughing, the periphery by absorption, without breaking down, and finally, by the middle of October or after three months' treatment, both the parotid tumor and the secondary one in the neck had entirely disappeared. The area of raw surface left at the centre soon healed over. It is now five months since the treatment was left off, and it is impossible to find the slightest trace of the disease either in the face or neck. The patient himself was never in better health.

#### A CASE OF POSTERIOR GASTRO-ENTEROSTOMY, WITH MURPHY'S BUTTON.

DR. WILLY MEYER presented a man, forty-nine years old, who, in April, 1897, was suddenly seized with a gastric hæmorrhage, followed by pain in the region of the stomach, and rapid loss of weight. When Dr. Meyer first saw him, in the latter part of 1897, the patient had lost over fifty pounds in weight and was very anæmic. A diagnosis of malignant growth of the stomach was made and an operation advised: instead of this, the man placed himself under the care of a general practitioner, who assured him that he would soon be cured by lavage, and it was not until February, 1898, that he consented to operative interference. At that time he was suffering very much from retention of food. An examination showed that the stomach contained no hydrochloric acid and a large amount of lactic acid.

February 21, 1898, posterior gastro-enterostomy was performed. The stomach was exposed through the median incision, and a cancerous growth of the pylorus was found. The pylorus was so freely movable that Dr. Meyer said he was at first inclined to do a gastrectomy; but the heart's action of the patient was so bad that it was not considered safe to prolong the operation. There also was a small cancerous deposit on the surface



of the liver, contraindicating such an operation. The upper portion of the jejunum was then found and one-half of a Murphy button inserted into it, an opening made through it about the size of a silver dollar, and the transverse mesocolon fixed to the posterior wall of the stomach by means of a few interrupted sutures. The second half of the Murphy button was then inserted through the stomach wall, and the approximation with the jejunum completed. During these manipulations the patient's pulse became so feeble that it was necessary to resort to an intravenous saline infusion. The patient left the table in good condition, but in the evening a second infusion was required. He made a good recovery. Button was passed on eleventh day.

Since the operation the patient has gained eight pounds. Dr. Meyer said that, if his condition warranted it, he would reopen the abdomen and resect the pylorus, excising the neoplasm, and closing the wounds in the stomach and jejunum.

With reference to feeding these patients after operation the speaker thought it could be done at once. The grasp of the button is so tight that there is practically no danger of leakage. With reference to suturing the abdominal walls in these cases, Dr. Meyer said he now always employed strong silk, passing the sutures through the entire thickness of the wall, close to the incision, and then adding a row of supporting sutures. He has discarded the use of silkworm gut, as in the male, at least, it is apt to tear through the tense abdominal wall.

Dr. Meyer said that very recently he had another case of congenital stricture of the pylorus in an infant, similar to the one he reported at the meeting on February 23, 1898. In his first case death occurred suddenly on the day following posterior gastro-enterostomy, and at the autopsy it was found that the smallest button until then manufactured, which had been inserted, was too large, and had entirely occluded the jejunum. His second case was a baby, eleven weeks old, also with a congenital stricture of the pylorus. Posterior gastro-enterostomy was performed, and instead of using the button suturing was resorted to. The operation, from beginning of the narcosis until its completion, lasted almost an hour and a half, and the child died sixteen hours later of exhaustion. The post mortem showed that everything in connection with the wound was satisfactory, but the child was so much emaciated that it had been unable to with-

stand such an operation. In his next case of this kind, Dr. Meyer said, he would again resort to the Murphy button, using a specially small size which had been constructed for him by Messrs. Tiemann & Co., and add, if necessary, immediate intravenous saline infusion into the vena saphena at the leg.

#### SUPRAPUBIC CYSTOTOMY AND NEPHRECTOMY FOR DESCENDING TUBERCULOSIS OF THE URINARY SYSTEM.

DR. WILLY MEYER presented a woman, nineteen years old, who was well up to six months ago, when she began complaining of frequent micturition and pain in the region of the bladder. She had an antelexion of the uterus, for which she was treated in the Gynæcological Ward of the German Hospital, and then, as her urinary symptoms persisted, she was transferred to the Surgical Ward. Her urine contained tubercle bacilli in great numbers. Her bladder was capable of holding only one ounce of fluid, and was so irritable that even under cocaine it was found impossible to use the cystoscope. It was thereupon decided to perform suprapubic cystotomy. The operation had to be done with the bladder entirely empty, and it was greatly facilitated by putting the patient in the Trendelenburg position. An inspection of the interior of the bladder showed numerous small tubercles spread over its surface; its rugæ were hypertrophied, and the mouth of one ureter was the centre of an extensive ulceration, and discharged pus. The other was surrounded by an apparently healthy area. A catheter was introduced into the latter and kept there for twenty-four hours, and an examination of the urine secreted by the corresponding kidney showed no evidences of disease. The suprapubic cystotomy was done on December 16, 1897, and on the 27th of December the diseased kidney was removed through a lumbar incision. In doing the nephrectomy, Dr. Meyer said, he resorted to an expedient which he has on several occasions found very satisfactory,—*i.e.*, putting a clamp on the pedicle of the kidney and leaving it there for forty-eight hours, when the operation can be completed without any trouble.

Dr. Meyer said that, although the ureter in this case was distinctly infiltrated with tuberculous disease, he did not remove it, because experience had convinced him that when the source

of suppuration is taken away the ureter usually gets well without giving rise to any further trouble. In some instances, however, he thought it must be removed.

Since the operation the patient has gained twenty pounds in weight, and her urinary symptoms have entirely disappeared. The suprapubic and lumbar wounds have closed.

In connection with this case Dr. Meyer showed the kidney which he had removed.

DR. GEORGE WOOLSEY said he had recently operated on a case where it was necessary to perform suprapubic cystotomy upon an empty bladder, and he agreed with Dr. Meyer that, with the patient in the Trendelenburg position, the operation was materially simplified and rendered easy, so far as getting access to the bladder was concerned.

DR. A. G. GERSTER said he agreed with Dr. Meyer that the Trendelenburg position was of great assistance to the surgeon in certain operations on the bladder, and he had never heard of any opposition to employing this posture in such cases. The speaker said that very recently he removed a tumor of the bladder in a man who had a double inguinal hernia, of enormous size. In addition, he had a bad cough, which would cause the herniæ to bulge out to such an extent that it was impossible to get at the bladder. On placing the man in the Trendelenburg position the difficulty was at once removed. Furthermore, with the patient in this posture, the peritoneum is much more easily taken care of, and a more thorough inspection of the bladder and internal urethral orifice possible.

Dr. Gerster said he was in accord with the opinion expressed by Dr. Meyer that it is not necessary to extirpate the ureter after removal of a tuberculous kidney. It is, of course, a good plan to remove as much of the affected tissue as possible,—just as we treat malignant growths,—but this principle has its limitations, which we must respect. In certain cases of this kind, where, in addition to tuberculosis of the ureter, we have to deal with a dilatation of that organ, the result of a stricture, complete or partial extirpation is probably necessary in order to bring about a perfect cure.

DR. A. J. McCOSH said it was well known that certain prominent gynæcologists and surgeons had a prejudice against the Trendelenburg position, and objections to it have been

brought forward by a number of operators. He agreed with the previous speakers regarding its advantages.

The speaker said that in a number of cases coming under his observation, where a tuberculous ureter was left behind after nephrectomy, it had given rise to considerable trouble. In three such cases it gave rise to a sinus, which persisted for over two years, and a subsequent operation was necessary to remove the source of the trouble. In one of those cases the patient's condition at the time of the nephrectomy was so desperate that it was deemed unwise to prolong the operation, and about one-half the diseased ureter was left behind: a sinus developed, which persisted for about two and a half years: in spite of this sinus, the patient's general health improved, and she gave birth to a healthy child: about three months ago, however, she developed chills and a temperature, and began losing flesh and strength, and on operating, Dr. McCosh found a retroperitoneal abscess, in the midst of which were the remnants of the diseased ureter. In another case, where he removed a large tubercular kidney, about two years ago, a sinus still persists, and when peroxide of hydrogen is injected into the sinus the patient passes frothy urine.

Dr. McCosh said that very recently he had a case where, in order to determine which kidney was diseased, a catheter was introduced into both ureters after opening the bladder above the pubes, and left there. At the end of eighteen hours three drops only of urine had been secreted by the kidney which was supposed to be diseased; the other kidney had not secreted a drop. The catheters were then removed. The speaker said he was unable to account for this almost total suppression, unless it was due to the shock of the operation or the presence of the catheters in the ureters.

DR. WILLY MEYER said he could not understand the opposition of certain operators to the Trendelenburg posture. In a case, for example, where the bladder is entirely empty it would be exceedingly difficult to enter it with the patient in a level position.

With reference to extirpation of the ureter after nephrectomy, Dr. Meyer said there no doubt are cases where it should be removed, either at once or at a later operation. In the ordinary cases, however, it can be left behind, and usually will not give rise to any trouble.

In order to expedite the introduction of a catheter into the mouth of the ureter after suprapubic cystotomy, the speaker said he had found it to be a good plan to catch the wall of the bladder with a forceps just in front of the ureteral orifice, and pull it right into the wound.

In regard to the case mentioned by Dr. McCosh, where the kidneys apparently failed to secrete any urine after introduction of the catheters into the ureters, the speaker said he had observed a number of such cases, where there was at first supposed to be total suppression, but on close study with the cystoscope it was found that the urine ran down alongside of the catheter; this is particularly apt to occur when the urine contains pus, which readily plugs the catheter. He also referred to another case where the catheter failed to drain until it had been pulled out for a distance of about an inch.

#### POSTERIOR GASTRO-ENTEROSTOMY FOR PYLORIC OBSTRUCTION.

DR. C. K. BRIDDON presented a man, fifty-nine years old. No family history of malignant or tuberculous trouble. No specific history. Uses alcohol in moderation. Has always enjoyed good health, with the exception that he has always been troubled with constipation.

Six months prior to his admission to the Medical Division of the Presbyterian Hospital, which was on January the 25th, he began to have dull, heavy feelings in the epigastrium after eating, which were relieved by vomiting. He did not vomit often, and it was only a little food, never any blood. Bowels have been very constipated, but there have not been any tarry stools.

His appetite has been poor from the onset, and for the past month his diet consisted of oatmeal and milk. He lost more than twenty pounds in weight, and got so weak that he could not walk upstairs.

After his admission to the hospital he vomited several times, and on one occasion the vomitus measured sixty-four ounces, and contained particles of food which had been taken two days previously. Constipation was obstinate, not having a movement of the bowels for seven days, and then only in response to a

cathartic. The analysis of a test meal showed the presence of free hydrochloric acid in moderate amount.

The patient was markedly emaciated and anæmic. The tongue was dry, red, and coated. The cheeks were sunken and the cheek-bones stood out prominently. The pulse was small and feeble. The chest was negative. The abdomen was soft and sunken and nowhere tender. No mass could be made out. The outline of the stomach could be readily seen through the thin abdominal wall, and verified by palpation and percussion. It extended in the median line from a point one and a half inches above the umbilicus to a point two and a half inches below it, and laterally from the left nipple line to the right nipple line, at the costal margins. The peristalsis of the stomach was plainly visible. Both inguinal chains of glands were enlarged.

Operation, February 9. Chloroform administered. Twelve minims of Magendie's solution had been given fifteen minutes beforehand.

Under the anæsthetic still no mass could be felt. An oblique incision, four inches in length, was made about one inch above the umbilicus. The peritoneum opened, the stomach with the transverse colon presented. The region of the pylorus was hastily explored, but nothing was found excepting what appeared to be enlarged glands in the mesentery. The man's extremely bad condition forbade any prolonged search.

The jejunum was then sought for and readily found. The transverse colon was held up by an assistant, and with the finger an opening was made through the transverse mesocolon, avoiding the veins, which were very large and numerous. The posterior wall of the stomach was now seized by the fingers and pulled through the opening in the mesocolon, and brought into close approximation with the jejunum. A purse-string suture was taken in the posterior wall of the stomach, which did not include the mucous membrane. The same was done on the side of the jejunum opposite the mesentery. An incision about three-quarters of an inch was made into the stomach in the area enclosed by the suture; one-half of a medium-sized Murphy's button inserted, and the suture tied. The other half of the button was introduced, and secured in the jejunum in a similar manner, and the two halves were approximated and locked with ease, completing the anastomosis.

Only two drachms of chloroform were necessary, and the operation did not appear to affect the patient to any appreciable degree.

Nutrient enemata were begun immediately and repeated every four hours.

On the next morning, sixteen hours after the operation, milk and warm water were given by the mouth in small quantities, frequently repeated. *Seven* ounces of *milk* and *five* of *water* being given during the twenty-four hours. There was no nausea or vomiting, and the patient's condition was considerably better than it was before the operation. The enemata were then stopped, not being retained.

On the second day the patient took one ounce of milk every two hours, one drachm of panopeptones every two hours, and half an ounce of whiskey every two hours. The total of fluids being thirty-seven ounces. On the third day the total of fluids was sixty ounces; on the fourth, ninety. On the sixth day scraped beef sandwiches and junket were given.

His condition was markedly improved. No nausea or vomiting. He continued to improve, and was able to get out of bed in three weeks after the operation. Four days later he was walking about the ward.

The button was passed on the fifteenth day.

#### THE OPERATIVE TREATMENT OF CHRONIC OVARITIS.

DR. L. S. PILCHER read a paper with the above title, for which see Vol. xxvii, p. 507.

DR. McCOSH said that in some cases of chronic ovaritis it is very difficult to decide what to do after the abdomen is opened, whether to remove one or both ovaries or a portion of one or both. In a number of instances coming under his care, where only one was removed, the symptoms recurred, and a second operation and extirpation of the remaining ovary became necessary. On several occasions he has also had cause to regret leaving in a remnant of a diseased ovary; on the other hand, some of the patients who were thus treated did perfectly well. He always endeavored to leave a portion at least of one ovary, and he considered it most important for the comfort of the patient to do so whenever possible.



Dr. McCosh said that his experience with chronic ovaritis in unmarried women has been that often the affection grows worse after marriage; such women are usually sterile, and eventually extirpation of the ovaries is demanded. On the other hand, in such patients, where the disease is not far advanced, pregnancy will frequently follow marriage, and after childbirth such women will generally—but not always—be much improved in health.

Dr. F. W. MURRAY said that, in operating on these patients, he always preferred the abdominal to the vaginal route, taking advantage, at the same time, of the Trendelenburg posture. Where such cases are operated on through the vagina, the speaker thought the work is often done in an incomplete manner, owing to the fact that the operator cannot see what he is doing, and must rely almost entirely upon his sense of touch. The speaker said he agreed with Dr. McCosh that it is occasionally a perplexing question whether to remove one or both ovaries completely, or do a partial exsection. He was in favor of leaving at least a part of the ovary, if it can safely be done. After abdominal hysterectomy it is better to leave the ovaries behind, if they are healthy, because by doing so we make the so-called menopause symptoms milder in character.

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*Stated Meeting, April 13, 1898.*

The President, ANDREW J. MCCOSH, M.D., in the Chair.

GASTROSTOMY FOR FIBROUS STENOSIS OF THE  
ŒSOPHAGUS FOLLOWING TYPHOID FEVER.

Dr. FREDERIC S. DENNIS presented a man, forty years old, who had enjoyed perfect health until July, 1897, when he had an attack of typhoid fever, which was very severe and disabled him for several months. After his recovery he began to experience difficulty in swallowing; this gradually increased until he was unable to take any solid food, and finally even liquids would regurgitate through the nose.

When he came under Dr. Dennis's observation, about eight weeks ago, the man had been nourished *per rectum* for some



time, and was greatly reduced. The introduction of a tube into the œsophagus disclosed an impermeable stricture, low down, near the gastric extremity. With the exception of the history of typhoid fever, no explanation as to the cause of the obstruction could be elicited. The man gave no history of syphilis and had never swallowed any strong acids or alkalies.

About two weeks ago gastrostomy was performed by Dr. Dennis. After opening the peritoneum the stomach was drawn out, stitched to the sides of the wound, and opened by cutting through its outer and middle coats, and then introducing a tube between these and the mucous coat. This opening has remained patulous since the operation, and through it nourishment has been introduced. The patient is now doing very well and is gaining in weight. Dr. Dennis said he had not yet decided whether to cut the œsophageal stricture or dilate it.

#### TUBERCULAR PERITONITIS AND PLEURITIS CURED BY OPERATION.

DR. DENNIS presented a young man who, in 1897, had an attack of tubercular peritonitis and double pleuritis, which had extended over some time. During this period he was running a normal temperature, and his weight had decreased to ninety-seven pounds. On March 17, 1897, Dr. Dennis opened the abdomen, and, after removing a large quantity of fluid, washed out the cavity with a saline solution. After closing this wound he tapped the left side of the chest and removed twelve ounces of bloody fluid; he then tapped the opposite side of the chest and removed eight ounces of fluid. Since the operation the man has gained forty-eight pounds in weight, and during the past six months he has been at work every day as a laborer.

#### RESECTIONS OF THE ELBOW- AND SHOULDER- JOINTS.

DR. DENNIS presented a case where the elbow had been resected for extensive necrosis following severe injury to the elbow-joint, involving the lower four inches of the humerus. The joint was resected and the diseased portion of the humerus removed, while the muscular attachments, as far as possible, were left undisturbed. The operation has left the man with

a very useful arm, capable of extreme flexion and extreme extension, and with strength enough to support his body while swinging from a bar.

A second case was presented, one of tubercular disease involving the upper part of the humerus, necessitating removal of about five inches of the bone. This has caused considerable shortening, but in spite of this has left a very useful arm.

A third case was shown by Dr. Dennis: a man whose right elbow was caught in an elevator, crushing it, and producing a compound comminuted fracture. The wound was covered with machine oil and all sorts of *débris*. It was at first thought that an amputation of the arm would be necessary, but as good pulsation could be felt in the radial artery an effort was made to save the limb. After thoroughly cleansing the wound the lower part of the humerus, including both condyles, was removed, and the torn muscular tissues sutured. A very satisfactory result was obtained.

DR. V. P. GIBNEY said that the tubercular joint cases tended to confirm the opinion he had long held that the functional results obtained by doing a complete resection in such cases, in the adult, are much better than with the non-operative method of treatment. In the latter cases the ulcerative process sometimes persists for years, with lingering sinuses, which occasionally heal, only to break out again, and finally a stiffened joint is left.

#### AMPUTATION OF LEG FOR PERFORATING ULCER OF LEPROSY.

DR. C. L. GIBSON presented a man, twenty-five years old (a mulatto), who had enjoyed good health up to five years ago, when the first symptoms of leprosy were observed. Though born in a community where the disease is endemic (Louisiana), his parents and other relatives have always been entirely free from the disease.

The first manifestation of leprosy began by an anæsthesia of the sole of the right foot, eventually spreading over the leg and up to the mid-thigh, although rather irregularly. Three years later a similar anæsthesia began in the left lower extremity. Areas of discoloration began to show themselves in the right leg, and tubercles were found particularly on the foot. Some time

afterwards necrosis of some of the toes of the right foot set in, and these were amputated in the Boston City Hospital, where some suspicions of the true nature of the disease were then entertained. Two years ago ulceration, beginning on the dorsum at the site of the metatarso-phalangeal joints, set in and progressed steadily with infiltration of the surrounding tissues. At that time he was sent to North Brothers Island as a case of leprosy. He entered the Almshouse Hospital, Blackwell's Island, last fall, coming there under Dr. G.'s observation. It was at his urgent desire that the feasibility of relieving his crippled condition by an amputation was entertained. He also argued that the ulceration of his foot, being the only tangible evidence of his condition, being once got rid of, he might make an effort to earn his living.

*Examination.*—Right foot: The chief gross lesion of the skin consists in single or conglomerate nodular thickenings one-half to two centimetres in diameter, sometimes superficially ulcerated and involving principally the derma, but often extending deep into the subcutaneous tissue. The nodules are distributed abundantly over the deformed stumps of the toes and along the external and dorsal aspects, but limited to the anterior two-thirds of the foot. Some of the nodules, especially along the outer aspects, extend deep into the subcutaneous tissue and communicate with lesions of the metatarsal bones.

The patient was informed that an amputation at the ankle-joint had but a very small chance of success. In view, however, of the decided advantages, from the practical stand-point, to be obtained from it, if successful, he decided to take his chances, although realizing that there was but little probability of a fortunate result in going so close to obviously infiltrated tissues. He agreed beforehand to undergo reamputation at whatever level might become necessary, and viewed calmly the possibility that even more radical operations might fail of a fortunate termination.

*December 29, 1897.*—Pirogoff's amputation with Günther's modified bony section. The operation was begun without the use of any anæsthetic, local or general. Till the deepest layers of soft parts posteriorly were reached the pathological anæsthesia sufficed, afterwards ether was found necessary.

The first appearances of the stump were fairly satisfactory,

but in a few days the lines of approximation gaped, and a slow, progressive sloughing of the whole stump set in.

*February 9, 1898.*—Reamputation by a circular skin-flap at junction of upper fourths of leg (still through line of anæsthesia). Ether was, however, used this time from the beginning. Union—though long, sluggish, and complicated with a moderate amount of indolent suppuration—was obtained, and the stump is completely healed and bids fair to be useful. The patient's general condition has also manifestly improved.

The specimens from both amputations have been carefully studied by Dr. James Ewing, of the Laboratory of the College of Physicians and Surgeons. So far unmistakable *lepra bacilli* have not been encountered; but, otherwise, the tissues examined show the usual changes observed in leprosy.

#### PLASTIC OPERATION FOR DEFORMITY OF THE NOSE.

DR. CHARLES MCBURNEY presented a young man who, twelve years ago, received a blow on the nose, causing a well-marked deformity of that organ,—the so-called "saddle-back" nose,—the bridge being sunk in and broadened.

With a view to overcoming the deformity Dr. McBurney cut from the crest of the patient's right tibia a piece of bone about an inch and a quarter long and nearly one-half inch wide. A straight incision was made vertically over the crest of the tibia, and the soft parts covering the bone were pulled to either side. The periosteum was not stripped back. With a small osteotome a curved line was cut on either side of the tibia so as to mark out a fragment corresponding to the nasal defect. This fragment was removed, and, without further change in its shape, was introduced through a small incision at the side of the nose, beneath the skin, over the depressed bone. The integument had been previously freely separated with a tenotome. The transplanted piece of bone had become quite firmly attached and the cosmetic result was excellent.

Dr. McBurney said he had been induced to try this experiment in this case because very recently he had removed a celluloid bridge from the nose of a patient, the reason for its removal being that it was very loose and had turned almost at right angles to its original position.

DR. B. FARQUHAR CURTIS said that while the cosmetic effect in Dr. McBurney's case was excellent, the question arose whether the bone was not likely to become absorbed in the future, unless it became attached to a living flap or to periosteum. In the case of Sabine, where the phalanx of one of the fingers was transplanted to the nose, the bone was gradually absorbed, and the nose grew much smaller. Celluloid, on the contrary, will remain unchanged.

DR. A. K. McCOSH said that on two occasions he had been called upon to remove artificial bridges—both of metal—from the nose, either on account of displacement or because of their irritation as foreign bodies. For this reason he thought the transplantation of bone was preferable to the insertion of foreign material.

DR. CURTIS said that metal bridges are usually placed inside the nose, under the entire thickness of the soft parts. In a case of his own, where he inserted a platinum bridge by the Roux method, the bridge gave rise to so much discharge and trouble that it finally had to be removed. The case was one of old syphilis, it is true, and the parts were particularly susceptible to infection. The speaker thought that in the majority of cases the insertion of a piece of celluloid between the skin and mucous membrane was preferable to a metallic bridge placed inside of the nose.

#### COMPLETE RESECTION OF THE CLAVICLE FOR OSTEOSARCOMA.

DR. MCBURNEY presented a young man who, about eighteen months ago, first noticed a small tumor near the inner extremity of the left clavicle. The growth rapidly increased in size until it had involved the inner two-thirds of the clavicle, forming a large prominence in that region.

Five weeks ago complete resection of the clavicle was done by Dr. McBurney. A long incision was made over the bone and the tissues were turned back; the hæmorrhage was not at all troublesome, and very little difficulty was encountered in freeing the bone from its attachments to the sternum and the acromion process. The operation consumed an hour and one-quarter. Union was obtained by first intention throughout. The patholo-

gist reported that the growth was an osteosarcoma. The deformity produced by the operation is scarcely noticeable, and the motions of the arm are nearly normal. There is no drooping of the shoulder on the operated side, and also no approximation of the head of the humerus to the sternum.

Dr. McBurney said he thought the lack of deformity left was partly attributable to the large amount of new tissue which had formed exactly in the right line, owing to the method of operation. The sterno-cleido-mastoid and trapezius muscles had been cut away above and the pectoralis major and deltoid below, and when the operation was completed these muscles were brought accurately together with many deep stitches. Primary union was obtained throughout.

The proper position maintained by the humerus might be accounted for by the fact that the patient is a muscular man, and that the humerus is held where it ought to be by the scapula.

#### SARCOMA OF THE COLON, WITH INTUSSUSCEPTION.

DR. F. KAMMERER showed a patient upon whom he had operated for a sarcoma of the colon at the splenic flexure. A woman, of fifty years, married, with a negative previous history, who had for some time been suffering from constipation, alternating with diarrhoea, and occasional severe paroxysmal pains in the left side of the abdomen. These pains had increased lately, and were accompanied by chilly sensations and vomiting of greenish matter. Her constipation was now very obstinate.

On admission she presented the following appearance: Very much emaciated, with a cachectic look; pulse, 96; temperature, 100.6° F.; abdominal wall very lax; in the left side of the abdomen, partly in the pelvis, a tumor, of a somewhat indefinite shape, could be easily felt; its long axis corresponded with that of the body; its consistency low in the pelvis was rather more firm than at the site of the descending colon, with which it seems, judging from its position, to be intimately connected. With the index-finger very high in the rectum the tip of an apparently round mass can just be reached, the nature of which is distinctly revealed by the sigmoidoscope; a pear-shaped tumor, about the size of an egg, of a greenish color at its tip, evidently

gangrenous and attached to the wall of the intestine. There was no distention of the abdomen and the patient's bowels moved freely before the operation. The tumor felt on palpation of the abdominal wall was to all appearances in continuity with the growth within the intestine. Upon the operating table, a few days later, the aspect of the tumor had somewhat changed: nothing could now be felt in the pelvis, but along the course of the descending colon, about at its middle portion, the mass was now detected. The question of what operation should be done was now easily answered. He had thought of making an osteoplastic resection of the sacrum, having been able to reach the tumor from the rectum, but now laparotomy was clearly indicated. Having incised the abdominal walls over the tumor an intussusception of about three inches was found and easily reduced, and it was then seen that the tumor, which could be plainly felt through the intestinal walls, had been situated at the tip of the intussusception. The intestine was incised by a longitudinal incision. The base of the tumor was now seen to correspond with the convex border of the gut, and was about three-quarters of an inch in diameter. It was excised with the tumor, the incisions being carried through the entire thickness of the intestinal walls. The intestinal wound was closed by a Czerny-Lembert suture. With the exception of a small stitch abscess in the abdominal wall recovery was uneventful. The report of the pathologist of the German Hospital, Dr. Schwyzer, shows the tumor to be a sarcoma, a very rare variety of malignant tumor of the intestine.

DR. WILLY MEYER spoke of two cases of intrainestinal tumors coming under his observation, both combined with intussusception. The first case was that of a woman who developed all the symptoms of acute intestinal strangulation. On opening the abdomen a double intussusception, about twelve inches from the ileo-cæcal valve, was found; after reducing this, a small, sessile tumor was made out in the intestine which had caused the original intussusception. It proved to be malignant, and, in order to obviate a recurrence, about four inches of the gut, including the portion from which the tumor sprang, was resected.

The second case was that of a boy, aged ten years, with symptoms indicating a chronic intestinal trouble in the ileo-cæcal region. On opening the abdomen an intussusception of

the ascending colon was found, which had to be resected, as its reduction proved impossible. An examination of the piece of gut which had been resected revealed the presence of a sessile, round-celled sarcoma. The patient made a good recovery from the operation, but subsequently numerous metastatic tumors developed in the abdomen. Patient died ten weeks after the operation.

DR. A. J. MCCOSH said that the limitation of the sacral operation in cases of this character was a very interesting question. He had recently had a case where, while doing laparotomy for another condition, he found a small cancerous nodule—about the size of a small pea—in the lateral wall of the rectum, eight inches above the anus. In order to remove this thoroughly it was decided to resect about two inches of the large intestine. This was done through an abdominal wound, but it was found so difficult to join the two ends of the severed gut in this situation that the operation had to be completed through a sacral wound. Through an abdominal wound it is difficult to reach within five inches of the anus, while through a sacral wound it is difficult to satisfactorily inspect a point as high up as ten inches above the anus. Of course, it is comparatively easy through a sacral wound to excise a much longer portion of the large intestine, even well above the sigmoid flexure, but for a lesion confined to the upper part of the rectum, say at a point seven or eight inches above the anus, the abdominal approach seems preferable.

DR. KAMMERER said that when these intestinal growths are undoubtedly malignant, resection of the gut is far preferable to mere extirpation. In his own case the gross appearance of the tumor, coupled with the fact that carcinoma of the colon is a rather rare condition, led him to believe that he was dealing with a benign growth. In spite of this, he extirpated it very thoroughly, cutting away quite a wide margin of the tissues surrounding its base.

#### TREATMENT OF FRACTURE OF THE PATELLA.

DR. L. A. STIMSON presented a paper on this subject, for which see page 216.

DR. GEORGE WOOLSEY said that Dr. Stimson, in his paper, did not mention the method of treating fracture of the patella by massage, perhaps because this method is rather new and still



under trial. The speaker said that during the past two years he had treated six or eight cases by this method, with very satisfactory results. One of these cases he had presented at a meeting of the Surgical Section of the Academy, about three weeks after the receipt of the injury, and at that time the functional result was perfect.

Massage, in the first place, removes the effusion in these cases and allows the fragments to be brought together. In some cases at the outset he had employed aspiration to reduce the effusion, in other cases he had not used it. Then by applying passive motion early an excellent functional result is obtained. Dr. Woolsey said that in a few cases treated by massage he had seen what appeared to be bony union occur. He regarded this method as superior to any of the other non-operative procedures.

As regards operative measures, the speaker said he had always objected to drill-holes and the introduction of silver wire, and preferred rather the suture of the fibro-periosteal flaps. In one case coming under his observation, where a third refracture had occurred, he was compelled to use wire, and then union was only possible after division of the quadriceps tendon. The patient made a good functional recovery.

DR. F. TILDEN BROWN showed an X-ray picture, and said he had recently had this case of secondary fracture of the patella, with a separation of at least five inches. The primary fracture had occurred about fourteen years before, and a separation had taken place gradually until last December, when the ligamentous band parted under some unusual strain. Dr. Brown saw the case about six weeks after this occurred. The joint was filled with fluid, and there was a marked posterior displacement of the lower leg. The case was first treated by rest, moist applications, bandaging, and massage; but as the improvement was not gratifying, and the patient was anxious to have the use of his leg as soon as possible, the joint was opened about ten days ago. The speaker said his intention had been to bring the fragments together as closely as possible, removing a cylindrical portion of the femur in order to accomplish this, if necessary, but the condition of the joint was found to be so serious that the functional use of the joint would have been ultimately impossible, even if the procedure proposed had been effected. Excision of the knee was substituted. The results of which the operator hoped to show at a subsequent meeting.

AN ABDOMINAL TUMOR RESULTING FROM  
CHRONIC APPENDICITIS.

DR. JOSEPH D. BRYANT presented a specimen, removed from a man forty-five years old, a hotel-keeper by occupation, whose family history was good, and who had no bad habits, with the exception of the liberal—although not excessive—use of alcoholic beverages. During the past year he had occasionally had some mild manifestations of gout.

In May, 1897, the patient noticed for the first time a small, flattened, elongated, painless tumor, about two by three inches in diameter, in the right lumbar region. For the following seven months the tumor remained unchanged, during which period the patient regarded himself as a well man. On December 23, 1897, he was seized with a chill, followed by fever and abdominal cramps; on the following day he was able to leave his bed, although still suffering from the pain. Towards night the pain located itself at the seat of the tumor, which became tender and painful. On the following day a physician was summoned, who diagnosed the case as one of appendicitis, and sent the man to St. Vincent's Hospital. His temperature on admission was 100° F. On December 28 he was seen by Dr. Bryant, who regarded the case as one of chronic appendicitis attended by marked exudation.

On January 14, 1898, the symptoms suddenly becoming more severe, the man was operated on by the usual incision in the right iliac region. A tumor was found which extended from the usual origin of the appendix upward almost to the under surface of the liver; it was parallel to the ascending colon, but was entirely shut off from the peritoneal cavity. It was quite easily enucleated, and was found to be in no way connected with the cæcum. The tumor was of cystic appearance, six inches in length and four in circumference at the largest part, and not less than three inches at any point. On opening the tumor it was found to contain a mass of necrosed mucous membrane, which resembled a decaying appendix, and this in turn surrounded a foreign body, apparently a piece of apple pericarp.

The wound was drained with gauze, and the patient made an uneventful recovery.

Dr. F. M. Jeffries, of the Carnegie Laboratory, to whom the tumor was sent for examination, reported that "the tissue removed had been submitted to Dr. T. M. Prudden for his opinion as regards its nature, as it presented some features more or less difficult to interpret. The doctor kindly examined it very carefully, and regards it as an extreme example of chronic appendicitis. Sections of the wall, taken transversely, show here and there small areas of undestroyed mucosa, but the greater part of it has undergone a complete necrosis. The submucosa is the seat of small, round-celled infiltration. In the muscular coats is a marked increase of interstitium with atrophy of the muscular fibres. This change thickens the muscular coat to many times its normal depth. The serous coat is in turn greatly thickened by successive layers of dense fibrinous exudate, so that in places it is even thicker than the muscular coat.

"The small body found within the appendix is vegetable tissue, and is probably a portion of apple skin."

TRANSACTIONS OF THE SECTION ON GENERAL SURGERY OF THE COLLEGE OF PHYSICIANS OF PHILADELPHIA.

*Stated Meeting, April 8, 1898.*

The President, T. S. K. MORTON, M.D., in the Chair.

THE PETROLEUM-ETHER MIXTURE OF SCHLEICH FOR GENERAL ANÆSTHESIA.

DR. M. L. MADURO introduced a discussion of the merits of the petroleum-ether mixture of Schleich for general anæsthesia by the statement that there was an intimate relation between the boiling point of the various narcotics and the temperature of the body. Since it is beyond doubt that narcotics with different boiling points must act in different ways upon an organism whose temperature is  $38^{\circ}$  C.

The Schleich anæsthetic is a physical mixture where no new compound is formed; it is a mixture in which each component part is taken up at the same boiling point. Schleich has laid great stress on the fact that the temperature of the body is constant, and a substance whose boiling point is equal to that temperature will remain in the body without breaking up into its fractional parts.

In one experiment he made the mixed gases began to dissociate (fractional distillation taking place). In this instance the boiling point was found to be inconstant, the substance separating by increased heat. There is no reason for surgeons to be averse to the anæsthetic because it is a mixture, for the component parts are not separated,—*i.e.*, they do not get the effect of the three ingredients one by one.

It has lately been proven by Weidig, a chemist in New York,

that the chloroform is not free in the mixture, but that a certain amount of sulphuric ether is in its free state, and only for that reason are we compelled to call the anæsthetic a mixture. It can easily be seen that this fault in the mixture is not a menacing danger; and this discovery has led Weidig and Willy Meyer to experiment with an improvement of the anæsthetic, whereby all the ether will be in combination, and a solution will thus be formed. This improvement goes under the name of molecular solution (M. S.), and we must wait for clinical experience to demonstrate its superiority. The relation of the boiling point to the temperature of the body will also here be adhered to, and a lower boiling point of petroleum ether is used to attain this result. The free sulphuric ether in the original mixture offers a probable cause for oft-noticed cyanosis.

Since it has been demonstrated that there is no free chloroform in the anæsthetic, it is obvious that the view held regarding the permanent impairment of function of the nerve does not bear any relation to the Schleich anæsthetic.

To seek a cause for the bad results noted is a difficult task. There is truth in the fact that too often a bad result can be traced to an improper administration. At one time the speaker thought that the grade of petroleum ether furnished was not up to the mark, but later analysis has proven that it is of good quality. Again, in a good many bad results reported, it may often happen that just those cases would have fared the same with any other anæsthetic. He had had an opportunity to prove this on one occasion, where, on account of stoppage of respiration, he continued with ether after the patient was resuscitated, and a while after there was a repetition of the same accident. There is danger in the administration of all general anæsthetics, but, to his mind, that danger is lessened with the Schleich anæsthetic. With each individual narcosis one should be on the alert for the unforeseen, and take all precautions as though that individual patient might be one of the few for whom the narcosis has especial dangers. One should ever bear in mind the fact that small doses will produce happy results when cautiously administered.

In his hands the paper-and-towel cone had always worked satisfactorily,—open at the top to admit a sufficient amount of air.

Others had used different forms of masks, and are in turn

satisfied with them. He was accustomed to pour on at first about a drachm for saturation, and reapply according as his judgment leads him to presuppose the patient needed, adhering to the drop method as much as possible.

He always used the No. 1 mixture to begin with, and rarely found much indication to use Nos. 2 or 3. In laparotomies lasting one and a half hours he had kept his patient completely under with No. 1.

In a recent communication Dr. Schleich had reported to him 1000 narcoses with his method without any unfortunate experiences.

He himself had studied 100 cases carefully, with the hope of arriving at a definite conclusion regarding the value of the anæsthetic. In these 100 cases the average time to induce secondary anæsthesia was seven and a half minutes, and the amount used for the same purpose averaged one-half ounce. The length of operation averaged fifty-five minutes, and the total quantity of anæsthetic used was two and three-quarter ounces. Patients recovered consciousness in an average of twelve minutes. Vomiting occurred on the table before the anæsthesia in nineteen cases, and here he could generally elicit the fact that some fluid had been previously given to the patient. In six cases vomiting was present during the succeeding entire twelve hours. In fifty-two cases vomiting occurred just after the patient came out of the anæsthetic; they, however, recovered in two hours, thus enabling them to pass a comfortable night. In twenty cases vomiting was absent altogether, but some nausea was present. In three cases vomiting and nausea were absent. In five cases a stage of excitement was noticed, and then it was mild in character. Pulse tension increased (pulse became slower and stronger) in eighty-four cases during operation. Stimulation with strychnine was required in four cases. One of these cases stopped breathing, the patient being a plethoric individual and subject to asthmatic attacks. Cyanosis was noted in fourteen cases; it was not persistent, being immediately relieved by admission of air. Pupillary reflex was gone in a few cases, although the patients were not thoroughly under the influence. Contraction of pupils on deep narcosis was uniform.

He had anæsthetized four cases with chronic bronchitis and six cases suffering from valvular lesions of the heart.

In one case, narcotized in a physician's office for twenty minutes, the patient walked home within an hour after he was out of the anæsthesia. No vomiting occurred.

Barring the one case quoted before, he had never seen the operation interrupted,—to watch the respiration and cardiac action, to elevate the jaws, to remove mucus from the throat, to clamp the tongue and pull it out violently, to press the ribs, or to await vomiting.

The advantages noted were freedom from choking sensations, as in ether; rapidity of inducing anæsthesia; comparative freedom from the stage of excitement; the usual occurrence of asphyxia; infrequent collection of mucus in the throat; increase of pulse tension; absence of persistent vomiting in most cases, which, according to Gerhardt, is the only cause of ventral hernia after laparotomies; absence of vomiting, especially noticed in short operations; the fact that it has been given with perfect safety and without bad results in chronic bronchitis and valvular lesions of the heart.

These conclusions made him resolute in his opinion regarding the true value of the anæsthetic, and firm in the conviction that if surgeons would exercise the patience to await the results of its more extended use, they will be in the possession of statistics which will warrant them in enlisting the Schleich general anæsthetic as one of the best and regular methods of inducing a narcosis.

DR. RANDOLPH FARIES said that Schleich's mixtures for inhalation consisted of three solutions, each solution being composed of three fluids,—namely, chloroform, petroleum ether, and sulphuric ether. The difference in each solution was the number of parts used and the boiling-point. Solution No. 1 was composed of forty-five parts of chloroform, fifteen parts of petroleum ether, and 180 parts of sulphuric ether: the boiling point being  $38^{\circ}$  C. Solution No. 2 was composed of forty-five parts of chloroform, fifteen parts of petroleum ether, and 150 parts of sulphuric ether: its boiling point being  $40^{\circ}$  C. Solution No. 3 was composed of thirty parts of chloroform, fifteen parts of petroleum ether, and eighty parts of sulphuric ether: this has a boiling point of  $42^{\circ}$  C. Schleich claims for these anæsthetics that they are less dangerous than chloroform or ether, and that their effects are not so prolonged. It is well known that all

anæsthetics, in small doses, are excitants, while in large doses they induce sleep, and if pushed to extremes produce death. Schleich made his experiments on animals, and from these experiments derived his formulæ. He based his experiments on the fact that an anæsthetic which will evaporate quickly will be eliminated rapidly by the lungs; and if it is not eliminated quickly less evaporation takes place in the lungs, and hence the anæsthetic is more dangerous. He was also aware of the fact that a substance evaporates more rapidly the lower its boiling point, and that the converse of this was true. The next question that presented itself to him was: What is the relation of the boiling point of the various anæsthetics to the temperature of the organism by which they are absorbed. He asserts that since anæsthetics have different boiling points (*c.g.*, chloroform,  $65^{\circ}$  C.; sulphuric ether,  $34^{\circ}$  C.; chloride of ethyl,  $15^{\circ}$  C.; and bromide of ethyl,  $39^{\circ}$  C.), they must act upon the body whose temperature is  $38^{\circ}$  C. in different ways; and knowing there was a close relation between bodily temperature and the boiling point of anæsthetics he made his experiments to see if he could discover a solution that would coincide with this relation. During his experiments he noticed that the amount of the anæsthetic used was also materially regulated by the boiling point of the solution,—*i.e.*, the more nearly the boiling point approached bodily temperature the greater the amount of the anæsthetic used. In addition to this, he also found that anæsthesia was much more profound when the boiling point was higher than bodily temperature. Knowing the boiling point of chloroform and ether,—the anæsthetics most commonly used,—one can readily understand why the anæsthesia of the former is more profound than that of the latter. Considering the foregoing facts carefully, Schleich made several solutions, with the view of changing their boiling point; and, after numerous experiments with animals, succeeded in preparing those mentioned. A point that Schleich lays stress upon is that the petroleum ether should have a boiling point between  $60^{\circ}$  and  $65^{\circ}$  C. The reason he employs petroleum ether is because he is able to use large doses without producing serious effects, and at the same time diminished the action of the chloroform. His method of administering the anæsthetic is practically that used in giving chloroform; but he advises the anæsthetizer to observe carefully



the amount employed. For an operation lasting about a half hour an ounce to ten drachms is sufficient. If a longer time be required one of the solutions having a higher boiling point may be selected, because anæsthesia will be more profound and less of the solution will be used. The advantages which Schleich claims for these solutions are that the anæsthetizer may be guided, as to the effects of the anæsthetic, by the respirations alone. He also states that patients awaken much quicker than when ether or chloroform has been used, and if the solution be used which has a boiling point about equal to the bodily temperature, only a few respirations are taken before the patient awakens. With the use of these solutions there is no excitement, no tendency to irritate the bronchial tubes, the pulse has a good tension and is never increased, but may be decreased occasionally. Vomiting sometimes occurs. Dr. Schleich has tested these anæsthetics in nearly 400 cases, with excellent results, and his claims have been sustained by many other surgeons. Dr. Faries had used the No. 1 mixture in one case and had noted the following effects: At first there was marked contraction of both pupils with internal strabismus, the axillary temperature was normal, there was no blueness of the face or lips at any time during anæsthesia, which lasted thirty-two minutes. The case was a child, about three years old, and its pulse and temperature were about normal, the pulse being 120 to 128, while its respirations were 30 per minute. The patient was given about seven drachms of the mixture. The statements of Dr. Schleich in reference to the rapidity with which a patient becomes unconscious and also regains consciousness were confirmed in this case. At no time did it require more than six respirations for the child to regain consciousness, and unconsciousness could be produced with the same regularity. There was no fall in the arterial blood-pressure and no vomiting followed. At one time there was dilatation of both pupils, to some extent, but this disappeared very quickly upon removal of the anæsthetic. The patient became unconscious with very little muscular resistance. Dr. Faries had also used mixtures Nos. 2 and 3, and had noted the following: The symptoms during the administration of mixture No. 2 were a slight increase in the pulse and respiration, which fell to normal when the patient was thoroughly unconscious, pupils slightly dilated, temperature normal, face flushed,

blueness appearing at no time, patient regained consciousness in seven minutes and a half, and vomiting did not follow. There was practically no vasomotor change. While using mixture No. 3 the symptoms were practically the same, with the exception that the pupils were slightly contracted and the patient regained consciousness more quickly. It is possible that regaining consciousness more quickly may have been due to the fact that the patient inhaled about a drachm less of the No. 3 mixture than was inhaled in Case II. Case II consumed seven drachms during thirty-one minutes, while Case III consumed six drachms in about twenty-nine minutes.

#### SIMULTANEOUS ADMINISTRATION OF OXYGEN AND ETHER FOR GENERAL ANÆSTHESIA.

DR. THOMAS S. K. MORTON stated that he had been using oxygen and ether for inducing anæsthesia since December, 1895, with increasing confidence and satisfaction. His cases now number in the hundreds, with but a single accident,—the carrying over of a little liquid ether in one case, owing to too rapid starting of the gas. This produced an alarming spasm of the glottis, but no serious consequences ensued. The first suggestion as to the simultaneous administration of an anæsthetic with oxygen was contained in the paper of Dr. H. L. Northrop, of Philadelphia, in the early part of 1895 (*Hahnemannian Monthly*, February, 1895, p. 81), in which he reported a large series of cases in which chloroform had been administered conjointly with oxygen. He also therein brought forward an apparatus which he had devised for the purpose, and a special inhaling mask modelled somewhat upon the lines of the well-known Clover appliance. In October, 1895, Dr. Carter S. Cole, of New York (*Medical Record*, October 12, 1895), reported an experience with the use of ether combined with oxygen, and endorsed the method as satisfactory. Dr. Morton has not employed chloroform and ether in combination, but frequently administers oxygen at the termination of chloroform anæsthesia. He has used the ordinary inhalation apparatus of the S. S. White Dental Manufacturing Company, simply placing ether in the wash-bottle of that appliance. It consists of a small, wrought-iron tank containing forty gallons of oxygen gas under pressure, a two-quart pressure-

equalizing rubber bag, and a wash-bottle and rubber tubing, connecting with any suitable inhaling mask. The latter should cover the nose and mouth tightly, and contain an inspiration and an expiration valve. Lentz & Sons, of Philadelphia, supply such a mask of exceedingly simple construction. The amount of ether carried over with the gas is regulated roughly by the depth of ether through which the gas is permitted to bubble up. If the supply-tube is deeply immersed, the maximum of ether will be carried over; if its extremity is but a little distance below the surface of the fluid, but little will be taken up. If it is desired at any time to give pure oxygen, the tube is elevated above the surface of the ether or detached entirely from the wash-bottle and directly connected with the mask. It has proved difficult to etherize children or nervous persons with the mixture, and the speaker usually prefers that all cases be etherized by the ordinary methods to the stage of primary anæsthesia before turning on the gas mixture. The latter is then generally sufficient to maintain thorough anæsthesia indefinitely. If otherwise, then a small bunch of gauze is introduced into the mask and additional ether poured upon it. At the termination of anæsthesia, or in case of collapse or other accident, pure gas is always made use of. The color of the patient's face is usually of a healthy pink hue throughout the administration, the heart beats full, strong, and with no undue acceleration. The respirations are likewise, as a rule, full, deep, and not greatly increased in frequency. Much less mucus is secreted, and therefore choking is infrequent. Vomiting seems to be less than in the ordinary methods, but not very markedly less. The blood in the wound is of an exceedingly bright crimson color, but hæmorrhage is certainly not increased by the oxygen. Cases by this method recover consciousness with great rapidity upon withdrawal of the anæsthetic and inhalation of the pure oxygen. Dr. Morton, since the accident above referred to, makes it a rule with his etherizers that the mask shall always be removed from the face when the gas is turned on or when a change is made in the amount flowing from the tank. A small bunch of gauze in the mask is an additional safeguard from liquid ether being carried over into the patient's mouth through too sudden starting or increase of pressure of the gas. The mixture is said to be more explosive than ether, hence especial caution must be taken with lights, the cautery, etc. In

intelligent patients it is a source of great comfort to know of the additional safety afforded by the anæsthesia method under consideration, and it is also a sustaining factor for the surgeon in bad cases when he has as much confidence in it as the speaker has developed.

#### IMPROVED METHODS OF ANÆSTHESIA.

DR. HOBART A. HARE said that anything which would tend to improve the methods which are employed to-day for the production of surgical anæsthesia is a good thing. If it is not good in itself, it at least is good in directing attention to the fact that prevalent methods of producing anæsthesia are not what they ought to be. This impresses the physician possibly somewhat more forcibly than the surgeon. The surgeon, by seeing a large number of patients put under an anæsthetic day after day, unconsciously becomes somewhat hardened to the condition that patient passes through in the preanæsthetic stage. Recovery from operation surgically may be satisfactory, but the physician, who has the patient sent back to him for building up of the system and care of the general condition, sees nervous manifestations which, if he is a careful student of his case, will impress him with the fact that, while they have been operative recoveries, many of them manifest for weeks and months after the operation distinct evidences of nervous shock. He thought that surgeons had gotten to regard surgical anæsthesia so lightly that, in the first place, they do not recognize sufficiently the dangers of it, and almost always overlook what might be called post-operative influence in nervous women. He had seen women who had been operated upon and whose entire nervous system had been altered. They have become irritable and peevish when before they had a nervous system which pursued the even tenor of its way.

Dr. Maduro had said much in favor of Schleich's mixture, but a number of cases had been reported in which unfavorable effects had been noted. In the *Medical Record* one writer says he will hereafter never employ Schleich's method. One can understand that such a feeling is natural, and yet he had often thought, when thinking over the possibility of developing a new anæsthetic, that there was one great difficulty which would stand

always in its way, and that was the unfortunate possibility of a fatal accident occurring in the first patient who took the new drug. If, for example, Sir James Simpson, after inhaling chloroform, had fallen under the table, with his friends, in a state of anæsthesia, and had been found dead under the table, it is probable chloroform would have received a blow from which it would never have recovered, but the mere fact that not one of the men died under chloroform speedily put this anæsthetic on a sound foundation. Bromide of ethyl produced very disagreeable symptoms in the hands of Levis a number of years ago, when first introduced, a shock from which it has never recovered, the bad effects being cited against it not only in this country, but all over the world. Therefore those cases which have shown untoward effects must be borne in mind, but not as distinct inherent disadvantages to the method itself. He did not understand what Dr. Maduro meant when he said that chloroform was not combined in the mixture and therefore would not have peculiar devitalizing influence on the nerves. It seemed to him whether chloroform is present as a separate integral part of the mixture or whether it enters into a compound, it is present as chloroform.

In regard to oxygen and ether there are several very radical faults in them. It is not proper to have the oxygen delivered to a patient through the bottle containing ether, for the reason that it is impossible to increase the quantity of oxygen delivered to the patient without increasing the quantity of ether delivered, and it is also possible to increase the quantity of ether without increasing the quantity of oxygen. Of course, by raising the tube it is possible; but this is a movement of the tube rather difficult to carry out in practice. Then there is more than this simple theoretical objection. His attention was called to this by the statement of a surgeon at the Pennsylvania Hospital who had given up the use of anæsthesia thus carried out by Dr. Morton, for the reason that it is difficult to put the patient under its influence. As soon as the mask is placed over the patient's mouth, which provides him with pure oxygen, there is produced what physiologists term apnœa, which is the reverse of what surgeons call apnœa,—that is, the patient ceases to breathe. In the physiological laboratories, when using artificial respiration in excess, it has been noted that the development of this condition of physiological apnœa causes a fall in arterial pressure, so that tension

in the blood-vessels may decrease practically to zero, and as vasomotor palsy is regarded by those who have studied chloroform a good deal as one of the dangers of anæsthesia, it seems a factor which is to be considered in the use of oxygen, chloroform, and ether mixture. The modification he had used is an ordinary inhaler, made of leather or some other material, which can be readily washed, with an opening in the small end, which can be closed if ether is being used, or, opened by means of taking off the cap if chloroform is used. Then he had a little metal tube attached to the rubber tube which goes to the oxygen-bottle, and then the cone is lined with fresh spongiopiline for each case, which is wet with ether. Ether and oxygen can be given separately and one can turn on the oxygen gas or cut it off. One can also regulate the supply of ether. It seemed to him that this was a very great advantage; that it is always advantageous in using drugs in combination to use them in such a way as to divorce or marry them at will. Almost any inhaler can be employed, and thus get the advantage of avoidance of physiological apncea, in which the patient stops breathing, and consequently does not take any ether, and speedily passes out of the influence of the anæsthetic. If nature meant us to breathe only oxygen, she would not have put anything but oxygen in air. If one chooses to add oxygen to that air for physiological purposes, well enough, but the patient should not have it pure. Therefore he thought an ordinary ether cone which permits the patient to breathe ordinary atmospheric air, and which provides him also with oxygen, is preferable to one in which he receives nothing but oxygen alone. Then, too, in the apparatus described by him it would be perfectly practicable to use Schleich's mixtures with oxygen, although he did not believe that it would be wise to bubble up oxygen gas through Schleich's mixture. He did not know what the chemical changes would be. This also still more holds true in the case of chloroform.

As to the ill effects of pushing drugs, he was very certain this was one of the points about which surgeons were not sufficiently careful. Very few surgeons are careful about the anæsthetic from beginning to end of an operation. Some surgeons do not pay much attention to patients during the time the inexperienced anæsthetizer is beginning. If jammed down their throat they have a certain amount of right ventricular disturb-

ance as a result of struggling, and they also get very much frightened while they are becoming unconscious; but when they get in the half-drunken state, they get sometimes horribly frightened. One woman had told him that all through her anæsthesia she had a horrible dream that some ruffian had her by the throat. In the cases where he had seen the ether given gradually it has done very well. One would not think of throwing so much chloral into a man's stomach as to put him to sleep in a minute. When using chloroform or ether one should attempt to slowly anæsthetize the nervous centres instead of overwhelming them.

He was very much impressed, as a surgical layman, with two instruments used,—that is, the mouth-gag and tongue-forceps. He had seen very few cases in which ether had been given in which it was necessary to use either of these especially horrible instruments, and he had seen patients torn and bleeding from the way in which the tongue had been brought out, and no one with any knowledge of anatomy of the tongue could conceive of such force being employed, as is at times, without grave injury resulting to the tongue thereafter. He had never seen a case in which he thought the mouth-gag was necessary; he had seen cases, on the contrary, where the jaws were so widely opened that the tongue fell into the back of the throat more readily than if the mouth had been kept shut, as people know who sleep with their mouths open.

DR. S. SOLIS-COHEN said that to take eight or ten minutes to get a patient under the influence of an anæsthetic is rather advantageous than otherwise, provided the patient be not frightened to death during the process.

In relation to this question of fright it was brought out very clearly by Sir Benjamin Ward Richardson—and it has been the experience of many surgeons as well as physicians—that there are certain patients who can be frightened to death, and whose death from fright plus anæsthesia might be attributed to the fact that a particular anæsthetic had been given, whether ether, chloroform, ethyl bromide, or Schleich's mixture. Any anæsthetic is dangerous in such conditions of depressed vitality. The chairman will doubtless remember a patient on whom he operated for appendicitis, and who approached the operation with such fear that they themselves dreaded lest the frightened condition of the patient might have an unfavorable result. He



was sure that if ether alone instead of ether and oxygen had been administered in that case the patient would have died. The anæsthesia was begun with ether given very carefully and the operation was done quickly, yet the patient soon after the incision was made passed into a condition so alarming that the ether was stopped altogether; oxygen only was given, and continued during the remainder of the operation, about eight minutes. The patient recovered quickly and without any ill result. His experience with the Schleich mixture had been *nil*, and he was therefore not competent to criticise it. He would say, however, from the stand-point of the physician, that nothing hitherto within the range of his experience could be at all compared with the ether-oxygen method for safety and absence of unpleasant complication or bad result.

Replying to Dr. Hare's criticisms of the method employed by Dr. Morton, for which he was partially responsible, he would say that unquestionably from the theoretic stand-point it would be desirable to have a method by which one could absolutely control the quantities of oxygen given and of ether taken up, the rate at which ether is taken up, and the proportions in which ether and oxygen should be mingled. His impression when they began using this method at the Polyclinic Hospital was that it would be absolutely necessary to substitute some other device for the passage of the oxygen through ether; but experience had taught him that it answered every purpose; that it was simple; that it could be readily taught to the residents, and that its regulability was much greater than one would suppose who had not worked with it. It impressed him forcibly in the case alluded to that there should be a means of rapidly detaching the oxygen conduit from the ether-bottle so as to give oxygen alone. In this case he simply slipped the rubber tube off the delivery tube of the ether-bottle and connected the tube leading to the mask directly with the oxygen-cylinder. There should be some means by which the slight fumbling and delay necessary to this could be avoided. His original mask, with which they began working at the Polyclinic in the latter part of 1895 simply consisted of the one used for compressed air, with the addition of an expiration valve. This has been admirably supplemented by Dr. Morton's exhaust valve, which cuts off ether at the moment of expiration. Dr. Hare's objection could be fully met by using



gauze and ether within the mask, and not using the bottle, or, better, attaching a funnel at the side of the mask through which ether could be poured from time to time upon the gauze within; but without practical experience of the method he doubted whether its advantage over the present method would be great enough to overbalance the simplicity of the latter. To increase the oxygen when the ether is increased he considered rather desirable both theoretically and practically. After more than two years' experience he was very well satisfied with this method of administration, with its safety, with its pleasantness, and with its after-results, and he would not like to have any patient of his own operated on for any serious condition whatever without oxygen at hand for resuscitation, even if it was not given with the anæsthetic.

As to admission of atmospheric air during the administration, he thought it would be objectionable. He believed that the reason the method is so safe and pleasant is because oxygen is entirely substituted for air. Patients do better when air is excluded and oxygen alone taken than when oxygen is omitted and air given. What the exact chemic and physiologic effects are he did not know.

DR. SAMUEL ASHHURST remarked that he had had a long experience with ether, and to this day he used some form of simple apparatus. He had never seen any reason to be apprehensive where good ether was used. If there was blueness of the face, by withdrawing the ether a little it soon passed off. If anybody would tell him how to stop the universal muscular tremor which comes on, which is always alarming to him and which he did not know how to control, he would be perfectly satisfied with ether as it is.

He recognized the fact that ether is often pushed for the sake of saving time, and the theory being that the less atmospheric air the patient gets the quicker he will come under the influence of the anæsthetic. It is a very brutal way, and it is very hard upon persons who are frightened, and it should not be done.

DR. JAMES K. YOUNG endorsed the administration of ether combined with oxygen. Cases on which he had operated, in which it had been given, had acted just as described by Dr. Morton. The cases in which the Schleich mixtures had been used he had had an opportunity of operating on also. The patients

went under the anæsthetic very rapidly and came out from under it after their operations very quickly. It is a very good anæsthetic, but his impression was that the patient was under and out too quickly for his own comfort in some of these cases.

DR. JOHN B. ROBERTS said that the method of anæsthesia which had appealed to him was to discard all kinds of inhalers; they are apt to be dirty, liable to cause infection, and always unnecessary. For long years he had always given it upon a folded towel (or upon some soft material, as gauze or a lady's handkerchief) covered with a second towel. The oxygen method Dr. Morton had spoken of he had used quite frequently. Physiologically the patient looks well and comes out of the anæsthesia well. He was apt to call for it if he had a doubtful case to operate on, one who has diseased heart or kidneys.

DR. C. L. LEONARD said that he was perfectly satisfied with ether as an anæsthetic. He was surprised to hear Dr. Hare's remarks upon the clinical aspects of ether, and he wondered where he had seen those cases etherized, or by whom. It was not his experience to see patients treated in the manner he spoke of. By gaining the patient's confidence, starting the ether gradually, until irritation wears off, and then continuing with increasing concentration of the ether vapor until the second stage is reached, the patients usually go off with very little excitation and recover fairly rapidly. As for vomiting, he thought it would be found with all anæsthetics, and that it was dependent in a great measure upon the individual and the anæsthetist. He had seen a great deal of chloroform given, and the patients vomited almost as frequently as they do under ether, and more frequently during anæsthesia. Vomiting is usually due to the condition of the patient before he goes into the anæsthetic state rather than to the anæsthetic itself, except in certain instances, where it acts directly upon the mucous membrane or upon the stomach, and produces reflex stimulation; but ether administered cautiously and with care does not require a tongue-forceps or the mouth-gag, does not require instruments, and the patient is perfectly safe so far as his recovery is concerned, and there are no untoward accidents. He had seen a death under chloroform anæsthesia in Europe, and all means of resuscitating the patient were of no avail; this is hardly possible with ether if it is carefully given, early recognition of the danger makes prevention possible

and recovery certain. There are ether deaths without doubt, as there are deaths from all anæsthetics, but ether given in the proper way is the safest anæsthetic that can be administered by a person skilled or unskilled in the giving of anæsthetics. It is more especially the anæsthetic which can be placed with safety in the hands of those not experienced in administration, and for that reason it is the best anæsthetic to be taught to the student about to graduate, or for the use of the general practitioner. The slowness of its action is one of its greatest advantages in these cases, for the unskilled anæsthetist is able to note the sequence of the steps as the anæsthesia progresses, and has time to recognize the danger before it is absolutely upon him. This is the most marked advantage of ether over the more rapidly acting anæsthetics, where the succeeding stages of the anæsthesia follow each other so rapidly that the skilled anæsthetist alone is capable of noting them. It therefore would seem that any anæsthetic which acts rapidly possesses this disadvantage in unskilful hands, and is consequently to be used only by a skilful anæsthetizer, and should not be taught as safe for the use of general practitioners or to undergraduate students.

DR. W. J. HEARN said that in his practice no man had ever complained of his tongue, as he had never yet pulled the tongue forward with forceps, and thought it entirely unnecessary. During anæsthetization the head should be slightly elevated, and kept in that position. If difficulty of breathing occurred from falling back of the tongue he pushed the jaws forward, as had been recommended by Dr. Hare.

DR. RANDOLPH FARIES said that in regard to the administration of anæsthetics judgment was to be used. He had used ether in about 2000 cases, and the only time he had noticed any symptoms requiring special attention was where he was asked to hurry. Further, he was safe in saying if the cone is held down tightly the larynx becomes irritated, there is a sense of suffocation and extreme nervousness on the part of the patient. By allowing a little air to pass between the cone and the mouth and nose until the larynx has become accustomed to the ether all unpleasant symptoms are avoided. In regard to the preanæsthetic stage, there is a necessity for considering the nervous condition of the patient. The result of this nervous condition is a production of waste material, which ultimately affects the kid-

neys. If, prior to an operation, the urine is full of sediment it seems logical to clean out the kidneys by a diuretic, such as pure water, which is as good as any. This is not done as a rule, and hence the patient is apt to have a congestion of these organs. The nervous excitement he had noticed in many cases, except when the anæsthesia was pushed too rapidly; he had never yet had a case followed by any muscular tremor when the anæsthetic was given slowly. If the anæsthetic is administered slowly and a certain amount of air is allowed to pass between the mouth and the cone, anæsthesia is easily produced. He hardly thought it justifiable to attribute unfavorable results to the ether when there are so many other causes.

DR. MADURO closed the discussion by stating that petroleum ether and benzine were synonymous in the United States Pharmacopœia. The benzine used in Schleich's mixtures are more rectified than ordinary benzine, which boils at  $50^{\circ}$  to  $55^{\circ}$  C. The benzine used in the mixture must have a boiling point of  $60^{\circ}$  to  $65^{\circ}$  C. The reason Schleich uses the petroleum ether is because it brings the chloroform in solution, and also because it is the least dangerous of all the ethers. As to the actual chemical reaction, it is not known. The indiscriminate use of anæsthetics is an evil. Surgeons should select their cases for different forms of anæsthesia. Personally he was always prepared to give any form, and did not wish to be understood as advocating that every one should use the Schleich method. Professional anæsthetizers should be encouraged in this country, for there is little doubt that most of the bad results come from improper narcotizations.

The mixture of ether-oxygen and Schleich's mixture would be a very good plan of administration, there is nothing that would contraindicate its use physiologically.

A mixture of nitrous oxide and the Schleich solution would be distinctly contraindicated, as after the cyanosis is established with the nitrous oxide one would have to crowd out all air with the succeeding anæsthetic to keep the patient under, and with the Schleich, containing chloroform, such a procedure should not be attempted. With ether it is possible.

A mixture in which the chloroform is in solution would not be as menacing a danger as where the chloroform was free. Most of chloroform deaths reported have occurred at the first

inhalation, due to the too concentrated fumes. The chloroform is in perfect solution in the Schleich solution, and it is only called a mixture because there is a certain amount of free ether contained. Dr. Roberts is truly correct regarding the inhaler. The simplest is the best. The paper and towel is far superior to Clover's or Allis's. It is the cleanest, cheapest, and most ready at hand.

## EDITORIAL ARTICLE.

### OBSERVATIONS ON GASTRO-ENTEROSTOMY AT THE Breslau CLINIC.<sup>1</sup>

ALTHOUGH the operation of gastro-enterostomy has now been practised over fifteen years, and, according to the author's research, there are over 600 cases on record, its results are not entirely satisfactory. The chief drawback has been found to be the establishment of a "*circulus vitiosus*," and most of the modifications of the original Wölfler operation have been undertaken for its correction. The writer's studies have been specially directed towards this particular phase of the operation, and are based on the consideration of the seventy-four cases in Professor Mikulicz's clinic, the recorded cases in the medical literature, and supplemented by experiments on animals and on the cadaver.

Of the seventy-four cases occurring in the Breslau clinic (1884-97) there were twenty-four deaths,—32 per cent. The operation was performed sixty-one times for the relief of malignant disease. Cause of death: collapse, 13; kinking and spurformation of intestine, 6; peritonitis, inhalation pneumonia, inanition, and myasthenia contributed to the fatal result in the remaining cases. Perfect healing without any intercurrent disturbances occurred only twenty-seven times. The greatest prolongation of life in cancer cases was two and one-quarter years and two and one-sixth years (still alive). All ten of the cases of operation for non-malignant disease are alive,—one ten and one-half years after operation.

The first four operations were according to Wölfler's

<sup>1</sup> Statistical and Experimental Studies on Gastro-Enterostomy, by Dr. V. Chlumsky (Breslau), Beiträge zur klinischen Chirurgie, Band xx, Hefte 1 und 2.

method. From 1891-96 von Hacker's method alone was used, except for three cases of carcinoma. In all there have been thirteen operations by Wölfler's method, with five deaths; von Hacker's operation, forty-three times, with fourteen deaths. The relatively frequent mishaps attending von Hacker's method, especially the kinking and spur-formation, experienced in the recent cases, led to a renewed trial of the Wölfler operation and to the development of a special procedure, employed eleven times, with five deaths. Five recent cases of anterior anastomosis with the aid of the Murphy button all recovered.

Considering the disturbances that follow gastro-enterostomy and the means devised to remedy them, we find that the following facts are brought out:

Wölfler's original operation (1881)—simple incision of the stomach and intestine—was apt to be followed by persistent vomiting. This dangerous symptom was, however, frequently observed in all the modifications of the original method. The vomiting, aside from that due to the anæsthetic and to the irritation of the peritoneum by chemicals, may occasionally be due to a rotation or constriction of the intestine at its point of attachment. In the majority of cases the vomited matter is not fæcal, but purely bilious, and the patient dies of inanition. An autopsy will show a dilatation of the stomach and of the proximal portion of the anastomosed loop, while the collapsed condition of the distal loop shows plainly that no food has reached it, the entire stomach contents having gotten into the wrong limb of the loop, and becoming stagnant there, are finally pressed back into the stomach causing incessant vomiting. Besides the intestinal contents bile is also forced into the stomach. If, however, the opening is made in such a manner that the gastric contents pass equally well into both limbs of the loop, matters soon regulate themselves, the proximal portion becoming narrower and the distal end dilated; the resulting intestinal spur will press more and more against the afferent or proximal portion.

In most of the cases the contents of the stomach became stagnant, notwithstanding the existence of active contractions. This result may be due to a marked contraction of the opening from an unusual degree of union and shrinking of the borders of the fistula. Or the longitudinal fibres of the stomach, having suffered but little damage by the incision, contract the opening by muscular action. The spur between the two intestinal loops may act as a wedge and block the gastric opening.

In a large proportion of cases it will be found that the stomach and the proximal loop are enormously dilated, the distal collapsed. In this condition the peristalsis of the first portion of the bowel has been insufficient to force out the incoming material, and has become dilated to the point of absolute stasis. In the cases that recover,—and a few do,—even after these ominous manifestations, the patient's strength has been sufficiently maintained to allow the intestines to respond with further peristalsis, driving out the contents of the loop along into its proper channel. Another cause is to be found in the dissimilar size of the gastric and intestinal openings, although these were originally made of an equal length, but the intestinal wall gives less, and the stitches are, consequently, inserted farther apart, resulting in considerable puckering, which may block the opening.

The chief cause of vomiting is generally attributed to the entrance of bile and pancreatic secretions into the stomach. To prevent this occurrence Wölfler proposed fastening the two viscera together so that their axis of peristalsis should be directed the same way; this improvement, however, failed to accomplish its end. Further modifications were devised. Wölfler, Czerny, Mikulicz, and many others, endeavored to narrow the orifice of the proximal loop. If this attempt was only slight, the gastric contents were not prevented from passing in; if the opening was rendered very narrow, an accumulation of bile and pancreatic juice took place, causing vomiting and symptoms similar to those of incarceration. In 1890 Lauenstein recommended making an



anastomosis between the proximal loop and another coil. A better suggestion was that of Jaboulay and Braun, of establishing a communication between the proximal and distal loops. The merits of this procedure soon became obvious, but it had the disadvantage of prolonging the operation, and certain operators (among them Braun) only employed it as a secondary measure to relieve intractable vomiting. This measure saved four of Mikulicz's patients from an apparently certain death.

Kocher, Doyen, Chaput, and others, sought to give the opening the character of a valve. Kocher's method has as yet not been much practised; Doyen's, while extremely complicated, has given its deviser excellent results. In either method the main principle of the operation is contained in the position of the attacked intestine, Doyen putting the proximal above the distal, Kocher the distal in front of the proximal loop. Hahn and others thought to diminish the dangers of spur-formation and the flow of bile and pancreatic juice into the stomach by making only small openings; the result was bad, as these orifices became greatly reduced in size. The reverse condition—large openings ten to fifteen centimetres long, as recommended by Stansfield and Senn—was not productive of any special advantage. The operation is longer, the danger of infection is increased, a spur may form, and, notwithstanding its size, the fistula may become obliterated.

Division of the gut, implantation of the distal end into the stomach and of the proximal into the distal segment below the site of anastomosis, was recommended by Wölfler and Chaput, but it is questionable whether even this procedure succeeds in keeping the bile from reaching the stomach.

Attempts have also been made to remedy some of the other unfavorable features of gastro-enterostomy. The loop of bowel selected for attachment varied greatly,—from the lower end of the ileum to that portion of the jejunum immediately succeeding the duodenum. Rockwitz used Nothnagel's suggestion of de-

termining the direction of the intestine by causing peristalsis with the application of salt to the bowel. The fallaciousness of this test was soon revealed.

In order to avoid the occurrence of a fatal peritonitis, so frequently observed in all methods of operation, numerous procedures not requiring the immediate opening of the stomach and intestines were tried,—application of chemicals to the mucous membrane, ligation causing sloughing of tissues, etc. These methods have not been found to present any improvements over those already known.

In 1887, Senn, with his bone plates, was the first to employ a new method, which sought more quickly and surely to establish an anastomotic opening. Numerous other devices based on the foregoing principle quickly followed. Of these the Murphy button is the only one that has stood the test of time. It possesses the following advantages: The operation is materially shortened, the opening is ideal in its working, the danger of infection is much diminished, the passage of the stomach contents outward is more quickly and easily obtained, and spur-formation is prevented.

Its disadvantages are: its size,—it either is so large that it fails to pass out of the stomach or it is so small that the opening is insufficient; it may not be passed out and thereby produce unpleasant complications; its results as regards mortality are scarcely any better than with the suture method. The use of the button should be limited to cases of malignant disease.

The chief cause of death after gastro-enterostomy is "collapse." Improvement in this direction, according to Czerny, must be sought for by a more judicious selection of cases, according to the author, in perfection of technique.

With regard to the various modifications of the original method, von Hacker's is only an improvement of Courvoisier's operation. This "posterior" gastro-enterostomy has been much employed in recent years, and gives comparatively better results

than the Wölfler operation. This advantage, however, may be only apparent, owing to the prevailing tendency to employ the simple anterior operation on the more desperate cases. Von Hacker's original contention that his method did away with the entrance of intestinal contents into the stomach has not been verified. The operation does not possess any essential advantages, and is attended with certain drawbacks less marked or wanting in the other methods.

CHARLES L. GIBSON.

## REVIEWS OF BOOKS.

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ARTIFICIAL ANÆSTHESIA. A Manual of Anæsthetic Agents and their Employment in the Treatment of Disease. By LAURENCE TURNBULL, M.D., Ph.G., Aural Surgeon to the Jefferson Medical College Hospital, Phila. Fourth Edition. Revised and enlarged. Illustrated. Philadelphia: P. Blakiston, Son & Co., 1896. 8vo, p. 550.

The appearance of a fourth edition of Dr. Turnbull's work on anæsthetics is sufficient evidence of the demand for this important book. The writer does not at this moment call to mind another single work on this important branch of medical science which pretends to cover the subject more than superficially. While there is an abundance of monographs, as well as endless discussions on the relative value of ether and chloroform, the other anæsthetic agents have been neglected, and are for the most part relegated to general works on therapeutics. The task of collating the vast amount of material available for such a treatise is by no means a light one.

In scope the book covers under separate chapters all the general and local anæsthetics, as well as a number of drugs, such as iodoform, which are not usually regarded as having anæsthetic powers. Nitrous oxide, chloroform, and ether are treated of at length, and a valuable chapter is devoted to their practical administration; a portion of the work especially intended for and of undoubted value to the medical student. Dr. Turnbull also presents at some length the results of experiments conducted by the Hyderabad Commission, by Drs. Wood and Hare, and others, as well as of some of his own.

A chapter on the medico-legal side of artificial anæsthesia is of interest. Brief mention is given to hypnotism as a thera-

peutic agent. The author has submitted in tabulated form a synopsis of deaths from chloroform and ether from 1887 to 1896 inclusive. This, supplemented by similar tables, copied from Gould and Hewitt, is of great value, as throwing light on the much mooted question as to whether the cardiac or the respiratory apparatus is the first paralyzed. It is to be regretted, however, that, as in most statistics, the reporter has neglected to present *all* the important points, so that the aggregate is not final.

It is surely fair to call attention to the poor literary form of the book, and to deplore the confused construction, which renders consecutive reading tiresome, and the obscure and faulty sentences which are of too frequent occurrence. The work would surely lose nothing if some of the descriptions of apparatus were omitted, as well as a number of quotations which do not seem altogether germane, and if less space were given to the chemistry and physical properties of nitrous oxide and other agents.

There is between the covers a great amount of material of real value, though it is surely a fair criticism to say that simplicity and clearness of style and diction are lacking.

HENRY GOODWIN WEBSTER.

ANNUAL AND ANALYTICAL *CYCLOPÆDIA OF PRACTICAL MEDICINE.* By CHARLES E. DE M. SAJOUS, and One Hundred Associate Editors. Volume I. Philadelphia: F. A. Davis Company, 1898.

This is the first of six volumes which are intended to cover the whole field of practical medicine. This publication is to take the place of the "Annual of the Universal Medical Sciences," which for ten years has been issued under the editorial management of Dr. Sajous, and which, in a set of five volumes each year, has annually put in a usable form at the command of the medical profession well-prepared and comprehensive digests of current medical literature. The editor in his preface says that experience has shown that, while the original plan was found to be of particular value to authors and teachers, it failed to provide

to the general practitioner that guide in all possible contingencies which such might desire, since often in the yearly output of digests particular subjects would fail to be included owing to the non-appearance of any article on that subject during the period covered. The present plan, inaugurated by this volume, is to construct a cyclopædia of practical medicine, in which, in alphabetical order, are presented systematic treatises on all general diseases, with statement of all progressive features of value presented during the last decade. Then each year to prepare a new edition, in which the new features of the year are embodied in their respective places in the text. If the year has brought forth nothing new upon any particular disease, the latter will, at least, appear as it was when last studied.

It will be seen at once how attractive the plan is. Each annual series of volumes putting at once at the command of the reader the present status of knowledge in any particular disease or remedy or procedure. The future must determine how fully this attractive scheme can be carried out.

The present volume begins with injuries of the abdomen, and closes with Bright's disease. It includes such surgical subjects, in addition to abdominal injuries, as actinomycosis, adenitis, aneurisms, and appendicitis. These are treated respectively by Ernest La Place, C. S. Wetherstine, J. McFadden Gaston, and William B. Coley. These subjects are treated systematically and with satisfactory fulness, and interspersed throughout the articles, in connection with particular sections of each subject appear digests from the literature of 1896 and 1897 pertinent thereto. Such medical subjects as Addison's disease, angina pectoris, albuminuria, alcoholism, and asthma are equally fully treated. The subjects are arranged in alphabetical order, and thus are self-indexing, making the book one of ready reference.

The scheme of the Annual is one of great promise, and the present volume gives reason for the expectation that the complete work will be one of great value.

LEWIS S. PILCHER.

INFLAMMATION OF THE BLADDER AND URINARY FEVER. By C. MANSELL MOULLIN, M.D., etc., Surgeon and Lecturer on Surgery to the London Hospital, etc. 8vo, pp. 153. London: H. K. Lewis, 1898.

This volume is presented to sustain and prove the septic origin of all cystitis. Taken up somewhat in detail, the author considers briefly, to make his book complete, the physiology, anatomy, and histology of the bladder. He holds to the idea that rhythmic contraction is the cause of micturition, and that the former results from pressure. He disproves, with illustrations, the theory that the entrance of a few drops of urine into the prostatic portion incites to micturition. In the same connection he notes the insensitiveness of the greater part of the mucous membrane, and denies the presence of glandular structures in the normal bladder. He states the inability of retention *per se* to cause cystitis. (See Melchior, "Cystite et Infection Urinaire.") The results of retention are only passive congestion and extravasation and exfoliation of epithelium at the neck of the bladder, and they in turn are aggravated by it. He doubts a constitutional predisposition, but suggests that a degree of immunity may be acquired in time. Because the glairy substance accompanying cystitis is not mucin but pus altered by the alkali, and as mucus is not secreted by the bladder, he urges the desirability of dropping the title "catarrhal cystitis" altogether.

He points out that practically all cystitis is suppurative, and demonstrates that pus organisms must be present. Retention, congestion, and trauma will not of themselves cause cystitis, nor will, in general, micro-organisms: they must act as accessory agents. He notes as exceptions, however, the urobacillus liquefaciens septicus and very virulent cultures of the bacillus coli communis.

Of the organisms present in urine he regards as most frequent the coli commune, especially in acid urine, and the strepto-

coccus pyogenes and bacillus liquefaciens septicus in alkaline. Besides these numerous special ones may be present in special cases, as the gonococcus, tubercle bacillus, and bacillus typhosus. It seems possible that the bacillus coli communis does cause ammoniacal fermentation in a slight degree, though injected alone into the healthy bladder it never causes cystitis; there must be traumatism present, as retention, congestion, or irritation. The presence of the streptococcus pyogenes is of grave import, the suppuration in such cases extending deeply into the bladder wall. According to Hallé it is especially frequent in cases where phlebitis is present. The urobacillus can produce cystitis by its simple presence, because the ammonia liberated by it is a sufficient irritant.

The staphylococcus pyogenes aureus is often found in advanced cases.

Writing on the symptoms of suppurative cystitis, he says in substance: "While the nerves of the neck of the bladder are normally insensitive to the presence of urine, in inflammation the contact of the urine is a powerful stimulant to contraction." The involuntary ejaculation of the few drops which are allowed to collect, and the accompanying strangury are characteristic of suppurative cystitis. The radiating pain, frequent urination, and, in severe cases, involvement of levator and sphincter ani muscles complete the picture of the local symptoms of an acute attack.

The constitutional symptoms are those of any infective process, and vary with the intensity of the infection.

"Urethral chill" and the occasional cases of collapse following the passage of catheters or sounds he ascribes for the most part to septic intoxication. To the same cause he attributes that class of cases in old men in which there is, following operation on the bladder, a slight febrile movement, anorexia, delirium, and death after a few hours. He traces the course of the infection from the already existing cystitis, spreading rapidly through the



ureters to the pelvis, and then to the kidney itself. He says, "The suppression of urine in these cases is the most prominent feature; but there can be little doubt that in the majority the actual cause of death is the septic poisoning." In support of this theory he urges the invariable presence of bacteria,—especially the *coli commune*,—the innocuousness of normal urine, and the necessity for an absorbing surface. In opposition to the theory of reflex irritation he urges that in many cases a catheter left in the urethra will relieve the chills, by draining off the infectious urine and protecting the abraded surface, while its presence alone would surely induce further chills were the reflex theory true. He does not, however, controvert Sir Henry Thompson, who has taught that death may result from emptying at one catheterization an over-full bladder, but claims that many of the cases of collapse which have hitherto been classed under this head are really due to septic intoxication. That the presence of virulent cultures of bacteria—especially the *bacillus coli communis*—in the urine has so long been unappreciated he ascribes to the fact that they thrive in urine that is highly acid without affecting its appearance or changing its reaction.

Treatment is systematized into prophylactic, general, and local. Under the first head the author lays great stress on the condition of the alimentary tract and urges the importance of intestinal antisepsis. Regarding catheterization he rehearses the difficulty of cleanliness, especially in using gum and silk or linen instruments. He urges the patient to pursue a course of boiling, rinsing, and soaking; that is much to ask from one whose training in asepsis has been neglected. He does not mention boiled oil as a lubricant, but pins his faith on glycerine preparations. The thorough washing each time of the prepuce and glans penis, as well as the hands, is urged, but it is surely difficult to impress the average patient with the necessity for such care. The greater ease of introduction of a gum catheter is enticing, but surely the cleanliness and cheapness of the soft rubber sort is more than sufficient reason for their preference whenever possible.

Under general treatment he calls attention (in all but light cases) to the need for rest in bed, elevation of the hips, hot baths, and light—especially milk—diet. He would discountenance alcohol, especially in the form of sherry, champagne, and beer. Alkalies are useful, but must not be given as routine treatment. Among drugs, he has had good results from boracic acid, benzoate of soda, salol, and calomel. He has found cocaine useless applied locally in the bladder, and urges opium as the only effective analgesic.

Regarding local treatment, after taking up catheterization and speaking of the "*cathéter à demeure*," the question of incision and drainage is taken up, and the author sums up his conclusions with the words, "I have never had occasion to regret having opened a bladder. I have often regretted that I did not do so at an earlier date." He favors the suprapubic incision, and mentions the technique of his method, as well as of the perineal operations, including puncture and drainage with the trochar and canula. Under the heads of irrigation and instillation a number of agents are referred to, especial notice being paid to mercuric chloride and silver nitrate. *Hydrastis canadensis*, a drug of marked efficiency in the local treatment of cystitis, receives no mention, nor does the siphon method of suprapubic drainage.

Of the specific infections, gonorrhœa, typhoid fever, and tuberculosis are considered, the first two briefly, the latter at some length. The treatment of tubercular ulcers of the bladder is taken up, and a plea made for early diagnosis, the results of operation being quite satisfactory in early cases. The author urges careful constitutional treatment in all tuberculous cases, and reports gratifying results even in unpromising patients.

The book is of convenient form and size, of inviting appearance, is interestingly written, and is, like all Dr. Moullin's works, of unquestioned value.

HENRY GOODWIN WEBSTER.

## METATARSALGIA OR MORTON'S DISEASE.

By ROBERT JONES, F.R.C.S.,

OF LIVERPOOL,

HONORARY SURGEON, ROYAL SOUTHERN HOSPITAL,

AND

A. H. TUBBY, M.S. (LOND.), F.R.C.S. (ENG.),

OF LONDON,

ASSISTANT SURGEON TO AND IN CHARGE OF THE ORTHOPÆDIC DEPARTMENT OF  
WESTMINSTER HOSPITAL; SURGEON TO THE NATIONAL ORTHOPÆDIC  
HOSPITAL AND TO THE EVELINA HOSPITAL FOR SICK CHILDREN.

THIS distressing affection is a neuralgia situated in the front part of the foot. The pain is of varying character, sometimes intense and sometimes dull. In the morning it is frequently noticed that the foot is free from pain in the less severe cases, but invariably after walking for a time the pain comes on. The affection is known by many synonyms: some of these are the following:

"Metatarsal neuralgia," "plantar neuralgia," "a form of painful toe," "a peculiar painful affection of fourth metatarsal phalangeal articulation."

The affection was originally described by Dr. Thomas G. Morton, of Philadelphia, in 1876, under this latter title, and from that time the whole literature of the subject up to 1895 is contained in a pamphlet, which he has kindly forwarded to us, and this list and that of the literature up to date we append to the end of this article.

Inasmuch as the cause of the pain is undoubtedly some alteration in the relationships of the various parts of the bony and ligamentous framework of the foot, it is advisable to describe these briefly. In text-books on anatomy the arches of

the foot are described as two,—the longitudinal and the transverse; and the longitudinal is said to consist of two parts, an inner and an outer. The inner part is composed of the os calcis, astragalus, scaphoid, cuneiform, and three inner metatarsal bones. The outer part is made up of the os calcis, cuboid, and two outer metatarsal bones. The transverse arch is spoken of as being formed only of the scaphoid, cuboid, and cuneiform bones. But this is less than the truth.

The metatarsal bones form a transverse arch at their bases, and to a less extent at their heads. When the foot is brought to the ground, considerable spreading takes place, especially of the transverse arch, at the heads of the metatarsal bones, and the foot is broadened at that spot about half to one inch, and the arch springs back when the foot is lifted. The degree to which the heads of the metatarsal bones are brought in contact with the ground varies with the tone of the structures binding them together. In some painful feet relaxation is more marked in the anterior than in the posterior part, so that many cases of this disease do not exhibit typical flat-foot or relaxed ligaments posteriorly. The best conception of the foot is that of a semidome, as Ellis has pointed out, and the two feet placed together make up a single dome. The arches, therefore, cannot be regarded as separate, but are portions of the whole, so that, given flattening in any one part, the remainder of the semidome suffers, and especially the relative position of the heads of the metatarsal bones to one another.

Dr. A. J. Chalmers has kindly prepared for us a coronal antero-posterior section of a frozen foot, and the relative positions of the heads of the metatarsal bones are well shown (Fig. 1). The second is in front of the first by one-quarter inch; the third is behind the second by one-quarter inch; the fourth is behind the third by one-quarter inch; the fifth is behind the fourth by three-eighths inch,—that is, the heads of the fourth and fifth are considerably behind the preceding toe. Now, if we examine the relationships of the plantar digital nerves to the heads of the metatarsal bones, we find

that they issue from under cover of the plantar fascia near the clefts between the toes, after passing between the heads of the metatarsal bones, but not deeply. The internal plantar nerve gives off four digital branches, the first for the inner side of the great toe, and the other three bifurcating to supply the adjacent sides of the first and second, second and third, third and fourth toes. The external plantar nerve



FIG. 1.—Diagram of frozen section, showing that there is most space between the metatarsals of fourth and fifth toes.

gives off two digital branches, one for the outer side of the little toe and one which bifurcates to supply the adjacent sides of the fourth and fifth toes. Now this latter branch receives a communication from the fourth branch of the internal plantar nerve. The position of this communication is of great importance in explaining the position of the pain in metatarsalgia. (Fig. 2.) The communicating branch passes

beneath the head of the fourth metatarsal bone. If a transverse section of the foot be made across the heads of the metatarsal bones, it will be seen that the first and the fourth (Fig. 3) bear the most pressure. It therefore seems that the neuralgia is a pressure neuralgia, and our explanation of most of the cases differs from that of Morton, which is as follows:

Morton says that the fourth metatarso-phalangeal joint is generally but not invariably affected. He states that the metatarso-phalangeal joints of the first, second, and third



FIG. 2.—Diagram showing the nerves generally trodden upon in plantar neuralgia.

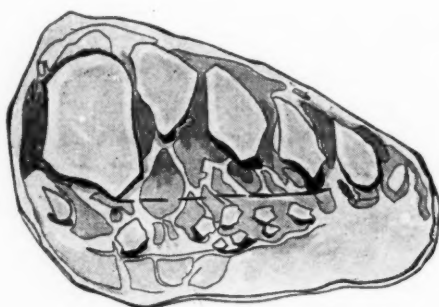


FIG. 3.—Transverse section of the foot across the heads of the metatarsal bones.

toes are almost in a direct line to one another, while the head of the fourth metatarsal is from one-eighth to one-quarter inch behind the head of the third, and the fifth is from three-eighths to one-half inch behind the head of the fourth. The fifth metatarsal joint is therefore so much posterior to the fourth that the base of the first phalanx of the little toe is opposite the head and neck of the fourth metatarsal. He also adds that the fourth has greater mobility than the first three metatarsal bones, and the fifth still more than the

fourth. If pressure be made upon the foot across the heads of the metatarsal bones, the head of the fifth metatarsal bone and base of the phalanx are brought into direct contact with the head and neck of the fourth metatarsal bone, and to some extent the extremity of the fifth metatarsal rolls over or under the fourth metatarsal. The branches of the external plantar nerves are distributed not only to the skin, but there are numerous small offsets of these nerves deeply lodged in the soft tissues between the fourth and fifth toes, so that if compression of the foot occurred they are likely to be irritated.

We have pointed out above the importance of the position of the communication between the external and internal plantar nerves as throwing light upon the cause of the pain, and this may be advanced as a reason for our venturing to differ from the explanation given by Morton. We shall also adduce clinical and therapeutic evidence in support of our contention that in many cases the communicating branch is compressed between the head of the fourth metatarsal bone and the ground. There are, however, cases in which the pain is not localized about the head of the fourth metatarsal but elsewhere in the transverse arch of the foot, and it may well be that the small offsets of the digital nerves passing deeply between the heads of the bones become compressed, and so give rise to pain.

For the sake of convenience in describing the affection clinically we will divide it into three degrees.

The *first* or slighter degree comprises those cases where pain, often shooting in character, is occasionally felt along the metatarso-phalangeal joints during certain acts, such as dancing, prolonged pressure of the feet in the stirrups, skating with straps tightly laced across the toes. But the pain quickly passes away on desisting from such acts.

In the *second* degree may be placed those cases where characteristic symptoms quickly follow either early attempts at walking after an injury, the wearing of an unduly tight pair of boots, or a sudden and unexpected movement.

Causes such as these appear to give rise to sudden yielding of the metatarsal arch at one spot and nerve-compression. It is in this class of cases that, on careful questioning, one finds that the pain is frequently relieved with a sudden click between the toes, and we venture to think the explanation of the click is that the head of one of the metatarsal bones is partially displaced downward from its fellows, and then either by flexing the toes or by swaying the foot about the subluxation is reduced and pressure on the nerves relieved. The following cases will illustrate this degree:

CASE I.—A young lady, aged twenty-four years, of weak ligament type, while patting a horse after a ride was trodden upon by its forefoot. Her foot became considerably swollen, not very painful, and no lesion worse than pressure-bruising could be observed. She was laid up for a week and then walked about in house-boots or slippers. In less than three weeks she complained of considerable pain behind the fourth and fifth toes, and frequently had no rest. The pain, however, went almost immediately on abstaining from walking or standing. This pain lasted two months, and only left her when appropriate mechanical treatment, to be described later, was employed.

CASE II.—Dr. G. H., aged forty years, having read an account by one of the writers of this paper on the affection, kindly sent the following letter: "I have been suffering from this affection for about six months. I first felt it in playing cricket. While fielding at 'point,' I turned round sharply to stop a hard ball and a sudden pain in the right foot nearly brought me down. The boot was a comparatively new one and had had spikes on the sole, but all of these had come out except one placed underneath the head of the fourth metatarsal bone. In the place of the spikes I had had nails put in, but these did not project from the sole as far as the solitary spike. As the ground was very hard, the chief pressure of the foot came upon the spike, and so an elevation of the sole was caused at that spot which pressed upon the fourth metatarsal bone. This, with a sudden twist, caused the pain which has continued with certain boots ever since. There is no corn nor any flat-foot, but if I get very tired the pain comes on severely and I find considerable relief by pressing on the toes



and separating the heads of the fourth and fifth metatarsal bones."

CASE III.—Mrs. P., aged thirty-four years, the wife of a medical man, stated that for two years past she had suffered agonizing pain in the left foot. She had tried all manner of boots and had failed to get relief. The pain was situated about the head of the fourth metatarsal bone. It was so severe as to render her life entirely miserable. As a rule, there was no pain in the morning but only a dull ache, but this increased whenever she attempted to walk, so that she was obliged to remove her boot at any cost. When the pain was very severe she would, so to speak, throw the foot about, when, after a time, a distinct click was felt and heard, and the relief was immediate. She was advised to have a boot made with some thickening on the sole just behind the head of the fourth metatarsal bone, and from this she obtained relief.

CASE IV.—Miss M. A., aged thirty-one years, was treated for severe bunion of the left foot. The head of the first metatarsal bone was excised and for a time all went well. After recovering from this, and on walking about in a pair of somewhat tight boots, she began to complain of a burning, darting pain in the fourth interdigital space. Relief from this could only be obtained by rapidly flexing the toes, and after a distinct sort of click had been felt. This patient was somewhat flat-footed, and before the operation for the bunion it was noticed that the sole of the foot was concave instead of convex across the heads of the metatarsal bones, and that the head of the fourth metatarsal bone was prominent with thickened skin over it. There can be no doubt that the removal of the head of the first metatarsal bone so weakened the anterior transverse arch as to make it the immediate cause of the metatarsalgia.

CASE V.—Mr. C., aged thirty-nine years, a bank cashier, and standing most of the day, complained of pain on the outer side of the foot which became so bad as to necessitate his giving up his position at his desk in the latter part of the day. His father had suffered from gout, but he himself had not at any time had an acute attack. On examination of the right foot there was noticed at once a peculiar inward twist of the front part of the foot, and the base of the fifth metatarsal bone was prominent, very painful, and with a false bursa over it. He com-

plained also of dull aching pain about the head of the third metatarsal, but it had never been paroxysmal. The arch of the foot was somewhat lowered, and, on examining the sole, a corn was found beneath the head of the third metatarsal bone, which seemed to have dropped away from the others. The boots he had been wearing were narrow in the tread and very pointed. He was advised to rest the foot entirely for a fortnight, and meanwhile a pair of low-heeled boots were made, with a valgus pad beneath the instep, and so arranged as to fit tightly across that part, and to leave ample room across the heads of the metatarsal bones in treading. It seemed to be highly probable that the displacement of the head of the third metatarsal bone arose from the pressure of narrow boots on that part of the transverse arch. To relieve the pain over the base of the fifth metatarsal bone it was suggested that the leather of the boot should be blocked out over the spot. A month afterwards he expressed himself as much relieved.

CASE VI.—Mr. N., aged thirty-two years, suffered paroxysmal pain in the front part of the right foot, which became so severe at times as to entirely prevent him moving about. He played much cricket, and had frequently been struck with the ball on the dorsum of the foot. The boots he was wearing were fashionable, and no doubt contributed to the perpetuation of the pain. The latter was always worse in the evening, and occasionally became agonizing in a warm room, and was accompanied by considerable redness and extreme tenderness in the first interspace. Relief was temporarily obtained by removing the boot. On examination it was noted that the arch of the foot had given way, the base of the fifth metatarsal bone was prominent, and anterior part of the foot twisted inward, and there were depression and enlargement of the head of the second metatarsal bone.

Relief was obtained by boots constructed on the same plan as in the previous case. He was also advised to soak the feet in hot water containing a drachm of bicarbonate of soda to the pint, and citrate of potassium was given internally. After some weeks the pain lessened and disappeared.

CASE VII.—Mr. J. D., aged twenty-five years, experienced pain and difficulty in walking. He could only hobble on account of the pain, and had tried all sorts of boots. The history of gout was well marked in the family. Pain complained of in both feet,

about the head of the third metatarsal bones, and over the base of the fifth metatarsals. In the soles of both feet the head of the third metatarsal was very prominent with a large corn on it, and in the right foot smaller ones were present over the heads of the second and fourth. The arch of the foot was much increased, and the toes of both feet were hyperextended. At times acute attacks of pain, lasting on and off for a fortnight, occurred, and completely laid him up. The inward twist of the front part of the perfect foot was well marked. So extreme was the displacement of the head of the third metatarsal bone on the right side that its removal was advised. As he objected to this and was anxious to try other treatment, bathing in hot water every night and boots closely fitting over the instep and very broad in the tread were tried, and considerable improvement resulted.

CASE VIII.—Mrs. S., aged twenty-four years, had been confined six months previously, and the first time afterwards that she went out for any exercise she felt a sudden pain in the right foot, and noticed a distinct "crick-crack" when the pain came on. Now she can walk for about a mile in comfort, then the pain commences and becomes throbbing and finally burning, and then the feet get so swollen that she must get the boots off as soon as possible. There is no gout in her family. The right foot is flat and the anterior arch is spread. The pain is situated about the head of the fourth metatarsal bone, and is increased by tightly grasping the heads and diminishing by pressure at the bases. There is a small corn beneath the fourth metatarsal head. She had been wearing badly shaped boots for a considerable time. She was advised to wear a bandage around the bases of the metatarsal bones and to have a special thickening in the sole just behind the painful spot. Unfortunately, she did not again present herself, and so the final condition of the case cannot be noted.

The *third* or severe degree is characterized by pain of so persistent, agonizing a nature as to entirely cripple the patient.

CASE IX.—In 1894 a lady of about forty-five years was sent by Dr. Willoughby Gardner, of Shrewsbury. She had consulted a number of our profession, but the ailment was ascribed to rheumatism, gout, or hysteria; and although Dr. Gardner had exer-

cised considerable ingenuity in trying to relieve the painful area from pressure by mechanical means, nothing seemed to give her any relief. On examining the foot there was some reddening of the third and fourth toes, and the nail was altered from malnutrition. There was no swelling. The patient seemed very hopeless and distressed, and had quite given up walking, which was impossible to her. There was distinct pain over the fourth metatarso-phalangeal joint. There were no callosities nor corns. The foot was flat, both arches having yielded. Appended is her brief description, which somewhat inefficiently describes her plight:

"It was in the early part of the year 1893 that I first began to be troubled with a pain in the third toe of my right foot whenever I wore boots: in loose slippers I felt nothing of it. As time went on the pain increased terribly, and my toe became swollen and discolored and the nail almost disappeared, drawn in by intense pain. I consulted several doctors, but they were unable to give me any permanent relief, and for more than two years my life was entirely spoilt by the pain in my foot, which I can only describe as sickening, like treading on something very hot. Since the operation, last July, I have had no recurrence of the old pain, and lately I have been walking several miles almost daily."

The operation will be referred to later.

CASE X was that of Mrs. S., aged twenty-four years. Her life, which was an active one, was rendered utterly miserable, as she could neither walk, hunt, nor dance. Her right foot was flat, with a yielding of the anterior arch. There was no swelling, nor any history of rheumatism or gout. Pressure on the first, second, third, and fifth metatarso-phalangeal joints was painless, but the moment the fourth was squeezed there was considerable pain. She complained of a subluxation, and certainly the joint appeared to be abnormally lax, but it could not, by manipulation, be dislocated. There was no redness nor sign of malnutrition. She describes her case as follows:

"The first complaint I had to make of my foot was in January, 1893, when, on walking any distance, a sort of cramp up my instep occurred, which, on continuing to walk, increased

up to my knee, and in several instances to my hip. Sometimes, however, I did not feel it, but this was very seldom. The pain described continued, until I was able to walk less and less. The warning always came in a sort of pain under the pad of the foot, as if walking on a hot marble, and then I became so lame and it so painful that I was obliged to stand still wherever I was, and hold my foot off the ground until the pain subsided. The early part of this year, 1895, it became so much worse that I had to remove my shoe or hop to some cab, as there was no chance of getting the shoe on again because of the swelling; and I was unable, as before, to press the foot across the instep, to get the toe back in what seemed the proper place; and often I heard it click back, and then the pain passed off for a time, but lately this did not act; hours often passed and I was in pain with it. I decided therefore to seek advice, and did so. It was operated upon, and now I can walk with perfect ease, and have never since experienced that feeling of a small bone out of place. I can in no way account for the origin of the affection, and have never hurt the foot in any way to my knowledge. However, I am very pleased with the operation, and think it a great success."

The following is an extract from a letter written by Dr. Macfie Campbell (Mrs. S.'s family doctor) four months after the operation: "2d November, 1895. I have seen Mrs. S. this week. She walks very well, and never spoke of her foot: a good sign."

CASE XI.—Miss C., a young lady of about twenty-two years, came from Ennis, County Clare. She thus described her case:

"On the 26th of December, 1892, I first felt pain in my foot, and went to a dance that evening. As it was at a house near, I walked to it, but did not feel any pain until beginning to dance, when I experienced a sudden sharp pain in the sole. However, I did not give in to it, but went on dancing, and by the end of the evening it was extremely painful. Next morning the foot was very much swollen, and so painful that it could not be put to the ground without great difficulty. Showing it to a doctor who examined it carefully, he said that he could not 'localize' the pain, but that I had better lie on the sofa for that day. The pain and swelling continued for just over a week: after that I could get into a very loose boot and walk a little, but not without pain, and in less than a fortnight I went out skating. There was no pain while skating, but directly I took off the skates and tried

to walk it came on again. By degrees it got better, but for about a month I could not dance without feeling it, and on taking a long walk or standing about much I felt it painful and swollen. After that it got quite well, until the summer of 1893, when, after playing tennis, it came on again, and then I painted it with iodine, which seemed to reduce the swelling, but it always felt worse in hot weather than in cold. It did not trouble me again until the following summer (1894), when I found that I had to get my right boot made wider than the left. In September, 1894, I went to Weymouth (where it first became painful) and there walked a great deal. It is a very hilly place; and after being there about a fortnight I began to feel the pain again, and in the evenings the foot was so swollen and hot that I could hardly put on my shoe. It went on like this, getting gradually worse (though there were some days on which I did not feel any pain) until about March of this year, when it got so bad that I almost gave up walking altogether, and it was particularly painful in damp weather. Then I tried what complete rest would do: for six weeks I did not walk more than a couple of hundred yards a day, and had the foot shampooed three times a week with very hot water; it then felt better, but directly I tried to walk again the redness, swelling, and pain came on."

This lady had a flat foot, broad at the base of the toes. The fourth and fifth toes were reddish, and slightly purple at the tips and the foot generally was cold. There was some swelling, but no heat. There was no evidence of hysteria, rheumatism, or gout. There was slight pain on pressure over the third articulation, but very considerable pain on pressure over the fourth.

This case gave more trouble than any on the list, as, owing to an indiscretion in the matter of walking after operation before the wound healed, its progress was retarded. There has also been some slight pain over the third toe, but not sufficient to justify operative proceedings. The original trouble has, however, quite subsided; and when Miss C. was met in Dublin she was on her feet all day, at the Leopardstown races and the Dublin horse show.

CASE XII is an instance of traumatic origin, leading to the third variety of metatarsalgia. She was a woman of fifty years, of neither gouty nor neurotic temperament, but who had some years previously suffered from subacute rheumatism. For a con-

siderable time she had not walked more than fifty yards at a time without experiencing agonizing pain. She says:

"In April of 1884, while pottering in the garden, I sprained my foot, but took no notice of it, and continued with my work. For a few days it was painful and swollen, and ached a little at night-time, but in two or three weeks recovered. I noticed, however, that for a few months my foot appeared to be weak, and occasionally the instep appeared swollen and felt full. For this reason I used to apply a bandage round the instep, which always seemed to give my foot strength. For two years, off and on, the instep pained me, and it had not quite recovered when in 1886 I fell down two or three stairs and again sprained my ankle. This time I remained for three or four weeks in bed, and my foot was encased in plaster of Paris. From that time to this (1895) I have never been free from pain on walking, but it was only in 1892 that it became so agonizing as to make my life a burden to me. From that date until this I have not been able to walk beyond a few yards without the greatest pain. At that time I travelled from London to Edinburgh, and started to do some shopping the following morning. After walking with my usual discomfort for about ten minutes the pain in my foot became almost sickening, and I went into a shop to sit down. On pulling the boot off, squeezing the foot, and grasping the instep, the relief was very marked. I then tied a braid bandage tightly across and replaced my boot. I had not gone a hundred yards before the pain again seized me, and it seemed as if all the nerves in my body were being drawn out of the sole of my foot. I walked a few yards on my heel, but could obtain no relief, so took a cab to the hotel. That evening any movement of my toes gave pain, and I awoke next day only to spend a more excruciating martyrdom than before. Five or six times the paroxysms came, only to be relieved by the removal of the boot and by squeezing the foot. I returned to London, and for a month remained under treatment. I consulted a surgeon, who recommended me to a physician, who treated me for rheumatic gout. Meanwhile, whenever I walked the pain came on. For twelve months I remained more or less a cripple, never deriving any benefit from any of the seven or eight medical men whom I consulted. The foot used to swell a little, sometimes it would redden over the instep, and the pain often shot up into the muscles below the knee. Sitting long in



one position, getting in and out of my bath, treading on a pebble,—any of these invariably induced a spasm. In short, from 1892 to the end of 1895, I would willingly have allowed my foot to be amputated."

This patient made a complete recovery after excision of the fourth metatarsal head. It was a typical case of plantar neuralgia, with flat-foot longitudinal and transverse, and great pain on pinching the metatarso-phalangeal. There were no nutritive changes in the toe.

CASE XIII.—M. C. F., aged forty-two years.

*History.*—About three years ago she noticed that on certain days she could not walk any distance without a sense of fullness of foot. It was always a relief when the boot was removed. The pain was localized as having been more marked over the scaphoid and also over the front of the foot. The relief was immediate on the removal of boot and of pressure. Some days there was no pain, even after long-distance walking. About two years ago she suffered an attack of subacute rheumatism, affecting mainly the left ankle and right knee. The ankle was much swollen. The temperature was at one time 102° F., and she remained in bed for a week. On recovery, the foot lost considerably in strength, and became hot and painful in walking, and this occurred constantly. The pain was mainly over the front of the foot, and sometimes the toes became cramped. The boot had to be taken off frequently in the day, and sometimes the throbbing and pain continued until the foot was plunged into hot water. No particular action on the part of the patient in the matter of flexing toes or manipulating them seemed to affect the issue. Towards the early part of the year the discomfort produced depression and loss of sleep and appetite. Patient was removed to the infirmary, where local remedies were applied. Among these figured iodine, lead, and opium, strapping and cautery. During recumbency there was no pain. On commencing to walk again the pain became more pronounced than ever, and plaster of Paris was applied, and often renewed. Another trial was made in walking, but without good result. On examining patient there was extreme flat-foot of a static kind, pain on pressure over scaphoid, and where the external malleolus impinged on the os calcis. The pain was acute on pinching the third and fourth metatarso-phalangeal joints. Operation: excision of heads of third and fourth. Patient in



bed for three weeks. In eight weeks announced herself as being free from pain, and has continued so for several months.

There was no flat-foot on right side.

CASE XIV.—A. E., commercial traveller, aged twenty-nine years. Four years' history of plantar neuralgia. Last two years, symptoms of lesion pronounced. (a) Pain over front of foot; (b) pain relieved by squeezing base of toes; (c) easier on removing boot and flexing toes; (d) often redness over toes; (e) swelling rarely.

On examination, pain over the fourth very slight, over second and third; flat-foot; no swelling.

Excised fourth. Bed three weeks.

Wrote to his doctor: "Am doing my eight miles a day without discomfort; have never looked back since the operation."

CASE XV.—Hallux valgus; plantar neuralgia; excision of first joint; rectification of deformity; disappearance of all symptoms.

Miss F., governess, aged twenty-two years. Five years suffered with hallux valgus and bunion. Considerable pain locally, but also flat-footed. Complained of much pain over base of toes. Boot has often to be removed. She was not able to walk far latterly. Obligated to sit down at school all through tuition. Extreme pain on pressing over fourth and second metatarsal. After removal of joint of big toe, symptoms quite relieved. Metatarsalgia gone.

This is most interesting, as showing the disappearance of a metatarsalgia on curing a hallux valgus. The recovery is no doubt due to the fact that more freedom of movement was allowed to the toes by the removal of obstruction to flexion.

CASE XVI.—Jane H. No good history to be obtained. Could not walk without pain for the last two years; sometimes the pain came on even when slippers were used. Very gouty family history. Both feet flat and both affected. Often had to walk on heels all day. No swelling or discoloration. Pain over fourth metatarsals on pressure. Excision of heads in both feet. Complete freedom from discomfort in two months after operation. Can stand all day in tobacconist-shop with but slight pain, which is easily endured.

CASE XVII.—K. J., aged forty-one years. Three years bad, but felt it for seven or eight. Had to leave business because of

acute pain. Feet flat; pain localized over base of toes. Eased by tying firm bandage round foot. Other symptoms similar to Case XV (Miss F.). Completely cured on removal of third and fourth metatarsal heads.

CASE XVIII.—J. H., sailor, aged thirty-four years. Operated June, 1893. Sprained right foot two years previously by catching foot under a loose plank on board "Teutonic." Pain constant, but sometimes very acute. Always easier in slippers. No pain at night-time. Pain lancinating and throbbing in character. Foot never swollen. For four months has not walked more than a few yards at a time. Toes often swollen and red after walking. Sometimes has considerable aching on inner side of leg. Handkerchief tied over base of toes gives relief. On examination, no swelling was found. The arches of the foot were much flattened: there was considerable pain over bases of third and fourth metatarso-phalangeal joints on pressure, which could not be so accurately localized in the absence of pressure. No movements of the foot by manipulation gave rise to pain. Circulation of foot good. Excised third and fourth joints. Patient walked one and a half miles at the end of the month. Seen in January, free from pain.

CASE XIX.—K. L., baker's assistant, aged twenty-seven years. Pain very severe for fully eight months before operation (August, 1895). Pain localized by patient over head of fourth metatarso-phalangeal joint. No enlargements to be made out. Off and on his club for last three months. Given two doctors' certificates that he was unable to follow his employment. Massaged and electrified by electrician without relief. Pain localized on pressure over fourth metatarso-phalangeal articulation. Removed base of phalanx and head of metatarsal. At work in six weeks. With the exception of severe cramps every now and again, which only last a few seconds, patient does not complain.

CASE XX.—F. J., aged twenty-one years. Fractured his third and fourth metatarsal bones, near their heads, in February, 1894. Injured by the fall of a safe, which was being moved from one room to another. Fracture not compound. Treated for three weeks, and then went to work in plaster support: considerable brawny swelling, which lasted several months, with some blue discoloration. Foot never easy for twelve months before operation. Described pain as being of a burning character

Very little affected by weather. No manipulation eased it. Often took boot off and bathed in hot water for an hour at a time. Off duty for two months. Foot sometimes became swollen over toes, but not always, even when there was pain. Often spent a day walking on heel, when walking was necessary.

On examination, August, 1895, considerable deformity, due to callus exudation at upper part of third and fourth metatarsals. Not painful, excepting on firm pressure. No pain over fourth metatarso-phalangeal articulation. No flat-foot. Some blueness of fourth toe, and often numbness.

Removed head of metatarsal of fourth, including callosities. Left callosity on third. Operation quite successful so far as pain, but foot yet remains weak, and easily tires.

CASE XXI.—K. F., aged nineteen years (Dr. Adam). Complained of constricted feeling over left foot, with occasional severe paroxysms over toes and front of foot. Remembers spraining it at tennis twelve months previously. Had been treated for flat-foot for two years, which was not of a painful character. She was a school-teacher, and for the last eight months could only get to school by taking an omnibus, and then hopping for a couple of hundred yards to the school. Her foot sometimes swelled, but was always relieved when the boot was removed, and the base of the toes pressed laterally in the direction of restoring the arch. It was easier, however, in tight than slack boots. She described pain as being of a sickening character, and so great that she often burst out crying, and had become quite depressed. She often, for relief, would walk on the inner side of the foot, but this only gave temporary respite. She sometimes had to sit on a door-step, and often called in at shops to relieve herself of the boot. No treatment gave relief. Strong muscular physique. Had arrived in considerable pain. Examined her foot, which was flat, without swelling or discoloration. A little pain over all metatarso-phalangeal articulations, worst over fourth.

Operated, and removed head of bone. Wound healed in four days. Walked with protected boot in a fortnight. Wrote three months after: "Move as if in a dream, scarcely believing the sufferings I have gone through."

CASE XXII.—J. W., aged thirty-seven years, for three years (1893 to 1895) in great difficulty when walking. No history of

injury. Had casts of foot, changed bootmakers, consulted surgeons and physicians, and beyond treatment for tarsal arch nothing was done. Boots moderately tight at sides of toes and well fitting over instep answered best. Often could not walk more than 500 yards without great pain. Relief always on removing boots. No history of gout or rheumatism. No swelling nor discoloration. Pain on pressure over fourth, and slightly over third and second. Removed fourth. Managed to walk in three weeks, and is now recovered. Sometimes an aching in the calf, over site of *tibialis posticus*.

CASE XXIII.—Mrs. W., aged fifty years. Subject to gout. Sprained ankle in May, 1893. In August complained of inability to walk distances without experiencing a pain which, starting quietly, gradually became unbearable. This disability grew, until at length she was unable to travel more than 300 or 400 yards. Has gouty attacks in consequence more frequent and severe. Towards middle of 1895 pain became very intense. Obligated often to remove boot. No redness, but often swelling over the front of the foot. Squeezing instep and rapidly moving the toes gave most relief. No medical measures availed.

On examination, foot flat; toes drawn up considerably, as in hammer-toe. No abnormality of circulation or innervation. Pain on pressure over second, third, and fourth metatarsal. Removed third and fourth in July. Symptoms considerably relieved during first two months, and now patient can walk two or three miles without discomfort.

CASE XXIV.—Fibroma of plantar fascia, giving rise to symptoms of metatarsalgia. Miss B., aged twenty-six years. Complained of great pain over toes, which often involved removal of boot and limited walking. Sometimes pain was acute. There was no history of injury. Pain and partial disability had occurred for twelve months. In character very like metatarsalgia. Pain sometimes paroxysmal, often relieved by lateral pressure. Fibroma found on foot.

This appears to us to be a very interesting example of the painful effect of pressure, simulating accurately, as it does, the commoner variety of Morton's foot. There was no flat-foot, and removal of the growth was quite effective.

CASE XXV.—Mr. S., from Windermere, writes:

"In the spring of 1887, when fishing with a heavy pair of

boots on, I suddenly felt a very sharp pain in my right foot. I walked home with difficulty, and could never subsequently do any walking with heavy boots on. So long as I did not wear heavy boots I felt no further inconvenience until about 1890, when my foot began to pain me if I walked more than about a couple of miles, and it gradually got worse and worse. About 1893 I found I could walk any distance only by wearing boots with very narrow toes, and until operated upon I continued to wear very tight boots, causing bad corns and general discomfort, but relieving me of the pain in question. During the last two years or so I have been unable to move freely about the house, with the most easy carpet-slippers on. When the pain came on it was most acute, and made walking impossible. I could obtain relief only by taking the boot off and compressing the foot in my hand for a few minutes. Under the advice of various and many general practitioners and surgeons I tried liniments, plasters, mechanical fixtures on boots, etc., all without obtaining the least relief. There was never at any time anything visibly wrong."

This gentleman, of about thirty-three years of age, was recommended by Dr. Clegg, of Windermere, and Dr. Heath, of Southport. He was very doubtful that anything could be done for him, and felt disinclined to be subjected to experiment. His foot gave him a very distressing time, and quite incapacitated him from out-door amusements.

His foot was very flat, and the anterior arch broadened immediately when brought to the ground. There was no swelling nor redness, and the pain on pressure was localized to the fourth articulation. A tracing of the sole gave no information. After operation the patient made a rapid recovery, and is now quite free from symptoms.

CASE XXVI.—Mrs. H. F., aged forty-two years, of strongly rheumatic history, hurt her foot ten years ago by treading on a stone while in her slippers. She was in Berlin at the time, where the foot was treated, and apparently recovered. From that time, however, dated the characteristic symptoms of plantar neuralgia from which she has since suffered. Three years ago the pain became much more constant, and she underwent a long course of treatment, with no benefit beyond that derived from rest. Her general health was so much undermined that the question of

amputation of the anterior part of the foot was seriously discussed in Germany. On her arrival in England, six months ago, she was prescribed brine-baths with no benefit. When we examined her she presented a very careworn and emaciated appearance, and expressed herself as willing to submit to any operation. She had lost weight to the extent of about three stones, and the constant pain had made her so nervous and apprehensive that she could sleep but very imperfectly at night. Her foot was not swollen. The pain was exactly over the fourth metatarso-phalangeal articulation. She sometimes experienced a click and often had to remove her boot. Grasping the instep gave her relief. She sometimes complained of pain over the sciatic nerve.

We removed the metatarso-phalangeal articulation, and in a fortnight the wound had healed.

This patient made an uninterrupted recovery, and in two months walked two miles. Apart from a little aching in both feet, doubtless due to the lax condition of tissues, she has not had pain since. Her general health is rapidly improving.

CASE XXVII.—Miss K., aged twenty-one years, had for two or three years been prevented from enjoying athletic sports of which she was very fond. The pain in her foot was extremely acute. She was often obliged to take her boot off wherever she happened to be, found relief from grasping the instep and plunging her foot in hot water. She was willing to submit to any operation, no matter how severe. Her foot was slightly flat, the anterior arch having yielded. The pain was fixed exactly over the fourth metatarso-phalangeal joint, and we accordingly removed the metatarsal head. The result was thoroughly satisfactory. In three weeks she went to a dance, joining in all, and feeling no ill effect.

CASE XXVIII.—F. Kohn, aged fifty-two years, a collier; complained of typical plantar neuritis, and often had been obliged to rest from work. He had ingeniously made a slot in his boot to relieve himself from pressure, but often at his work was obliged to take his boot off. He dated his trouble from the fall of a piece of coal, some eighteen months previously, which had given rise to flat-foot. There had been no fracture of the metatarsal bones. The pain was over the third and fourth metatarsal. He often heard a click on moving the toes. Both metatarsal heads were removed, and the patient made an uninterrupted recovery. His

doctor states that in three weeks he went to his work, and has not complained for the last six months.

CASE XXIX.—Miss A. L. J., aged thirty years, has been troubled for four years with pain in the left foot. When she first noticed it she had been wearing a thin pair of boots, and at that time, while out walking, she suddenly felt as if she had trodden upon a marble. The foot ached on and off at first, and, being a school-teacher, she always felt it about 4.30 P.M., when she had been standing all the afternoon teaching. In order to obtain relief she took to wearing shoes. Two years ago the pain became much worse, beginning earlier and earlier in the day, and compelling her to ride to and from the school instead of walking. The pain she described as being at first numb, like a tooth with a bad cold in it, and then it would become burning, and finally gave her the sensation of a hot needle being run into the foot with acute pain radiating up the whole lower extremity. She had seen two or three medical men, one of whom said it was neuralgia, and the others rheumatism. The last summer the pain was so bad that she was often obliged to stay at home, as she could neither wear boots nor shoes. At times it was so intense that she did not wish any one to come near her, and it made her, as she expressed it, suicidal. When she put her foot to the ground she noticed a distinct click, but this could not be obtained by moving the affected toe passively. She also said that when the pain was not so severe plunging the feet into cold water would stop it. When the pain had become almost unbearable she felt as if the foot stiffened, and said that the veins rose up like a net-work of threads. On examination the left foot was found to be somewhat flat and the anterior transverse arch had fallen. The head of the fourth metatarsal bone was prominent on the sole, but there was no corn over it. The pain could be readily elicited by pinching that metatarso-phalangeal articulation between the thumb and forefinger, but it was not increased by squeezing the heads of the bones. In fact, it was rather relieved than otherwise. There was no redness about the foot, but the veins looked full. She readily consented to have any operative measure, even amputation, done if the pain could be got rid of. It was pointed out that by excising the head of the fourth metatarsal bone complete relief could probably be obtained. This was accordingly done through an incision on the dorsum. The con-



dition of the plantar digital nerves was carefully noted, and it was found that the branch of the external plantar nerve supplying the adjacent sides of the fourth and fifth toes was much enlarged, dark red, and congested, and running on it was a small dark vein. The excised metatarsal head was unduly prominent below. The patient completely healed up in a fortnight, and the pain was entirely relieved.

CASE XXX.—Mr. S. was seen on account of severe pain in both feet. It had gradually increased for some time past, and was so bad as to prevent him walking the short distance between his house and place of business. There was a history of syphilis some ten years before. The pain was relieved by taking off the boots and placing the feet under a cold-water tap, but when it was present it was sickening and utterly laid him up. As a rule, it was quite well in the morning, but it began to throb about 10 A.M. and became steadily worse during the day. There was no flatness of the feet; the pain was worse between the first and second and second and third metatarsal bones of both feet, but he could gain relief by hyperextending the metatarso-phalangeal articulation and acutely flexing the toes. There were no corns in the sole of the foot, but the heads of both second metatarsal bones were prominent. He elected to be operated upon, and the heads of both second metatarsal bones were removed. Twelve days afterwards the right foot was nearly healed and the left foot entirely. He expressed himself satisfied so far with the result of the operation, but he afterwards wrote to say that he had had some return of the pain in another part of the arch. Being abroad, he was unable to return, and it might have been better in his case, despite the fact that the pain was localized more about the head of the second metatarsal bone, to have excised the fourth. Although the pain in foot was so extreme, he always persisted in stating that it was about the head of the second, and that being the most prominent bone, it was accordingly removed. At the operation the digital nerves in the neighborhood of the second metatarsal bones were much enlarged and red.

With the above cases should be compared six other cases which are contributed by Dr. T. S. K. Morton and a few cases also published by Dr. T. G. Morton, who first wrote on metatarsalgia. These cases are to be found in a pamphlet



founded on a paper recorded in the Philadelphia Academy of Surgery in 1893, and brought up to date, in 1895, by Dr. T. S. K. Morton. The descriptions are so graphic that they are well worthy of perusal.

*Symptoms.*—Reviewing the preceding cases, these may be collected together as follows: (1) The pain. This is either dull at the onset or else is acute from the first. In all cases, if left untreated, it becomes more severe and may and frequently does incapacitate the patient, rendering his life entirely miserable. Nor is it confined to the foot, but starting about the head of one of the metatarsal bones is reflected up the limb. As a rule, no redness is present, but in seven cases congestion has been seen. A very characteristic remark of the patient is "that he must remove the boot and hold the front part of the foot firmly." (2) Deep tenderness is frequently present about the heads of the third or fourth metatarsal bone, and the most characteristic symptom is the fact that the pain can be elicited by firmly grasping the fourth metatarso-phalangeal joint between the thumb and the finger. (3) The affected foot is broader across the heads of the metatarsal bones than is normal, and some degree of flat-foot frequently exists, but by no means always. (4) On examining the sole a large corn can sometimes (in three of thirty-one cases) be seen over the head of either the second, third, or fourth metatarsal bone, one of which is frequently felt to be prominent. (5) A peculiar twist is present in the foot. The portion in front of the tarso-metatarsal articulation is twisted inward so that the base of the fifth metatarsal bone is exposed to the pressure of the boot. The patient complains of constant pain at that spot; in fact, in some cases—and these are early instances—the patient seeks relief from this alone. (6) The impression of the foot is typical. There is a bulging instead of re-entering angle behind the ball of the great toe. It is very unusual for all these symptoms to be present in one case. Some of them are fairly constant, others may be said to be common, and others are exceptional; but it will be found that in all the cases a complaint of pain is

made on walking. Now this pain is quite different in character to that of the so-called painful spasm in flat-foot, inasmuch as the pain in metatarsalgia is in its extent and area strictly localized, and at the same time is much more severe and paroxysmal. Again, the painful flat-foot is frequently found to be cold and blue, while Morton's disease appears to be associated with healthy nutrition. In the milder varieties pressure has to be continued for a long time with the thumb and the finger before pain is manifest. In the severe cases less pressure produces much greater pain. In the first and second degrees the pain is neither so acute nor spasmodic as in the third. In twenty-five cases out of thirty there was pain on pressing either on the second, third, or fourth metatarso-phalangeals. In two cases there was pain on pressing the second metatarso-phalangeal, in twelve cases on the fourth, and in three cases all three (second, third, and fourth) were so affected, and in case thirty it was between the first and second. The significance of this symptom,—namely, the eliciting of the pain by digital pressure on the head of the fourth metatarsal bone,—in explaining the cause of the affection, will be dwelt upon presently. In nearly all the cases reported prolonged treatment elsewhere had been adopted, and the complaint was generally ascribed to gout, rheumatism, and hysteria. We know well how that structures which have been stretched or otherwise injured will often become influenced by one of the three above-mentioned affections; but, apart from this possibility, there was no evidence of their existence in the majority of our cases. Nor in any one case could the symptoms be put down to hysteria. The descriptions were too graphic and the pain was too real to be feigned. From an analysis of symptoms in these thirty cases it will be noticed that there was a history of injury in ten cases; that the third joint was affected as well as the fourth in nine cases; the lateral pressure gave relief in eleven; that reference was made to subluxation or reduction with a click in six; that there was flattening of both longitudinal and transverse arches in eleven; that nineteen patients were

women, and eleven men; that five described sensations as if standing on something hot; the ages ranged from nineteen to fifty; that in one case symptoms were induced by pressure of callus due to fracture; that in one case symptoms were induced by a small fibroma of plantar fascia; that symptoms of gout or rheumatism were only found in one case; that flexion of the toes in the majority of cases was productive of relief. T. S. K. Morton remarks, the disease has not been observed before adolescence, and that is our experience. He adds that women are certainly more predisposed than are men, and its occurrence in the former sex, he judges, to be almost twice as frequent as in the latter. One foot is most usually involved, especially in those cases apparently taking origin from an injury, but very frequently one foot is affected to an almost unbearable degree, while its fellow is only slightly involved. That foot which is constantly subjected to movement, such as running certain sewing-machines, lathes, or looms is more likely to suffer than the one which is not so much used. When both feet become simultaneously affected, the cause will often be found in ill-fitting or tight boots. Middle life is the period at which the disease is most apt to develop or become severe. The aged are by no means exempt, although in them the more purely gouty or neuralgic forms are prone to appear, and persons at any age so predisposed appear to be much more liable to the affection—idiopathic or traumatic—than are others. Morton also remarks that the influence of heredity is great, and he knows of several families of which a number of persons, mainly confined to the female sex, are similarly affected. We have not carefully gone into the question of heredity, and so we are not prepared to make any statement on this point.

We would now take this opportunity of discussing more fully the causation of the pain. In briefly reviewing the anatomy of the foot, as far as it is concerned with the production of this disease, we have already alluded to the explanation advanced by T. G. Morton, and we there remarked that in the communication which exists between the external and

internal plantar nerves beneath the head of the fourth metatarsal bone was to be found a probable explanation. And we further advance the theory that in most of the cases the neuralgia was a pressure neuralgia. We venture to dissent from the theory of causation as advanced by Morton, and to a very considerable extent followed by all subsequent writers, on the following grounds: (1) The plantar digital nerves, instead of passing between the heads deeply, lie quite superficial and on the transverse metatarsal ligaments, and when the foot is pressed upon they are pushed away from, not necessarily between, the bones. (2) It is not proved that the anatomical position of the heads of the third, fourth, and fifth metatarsals is favorable to a nipping of the nerve on lateral pressure; on the contrary, there would be less escape were the metatarsal heads in absolute line. (3) That in the majority of cases a painful spot can be found intensely sensitive by pinching with the thumb on the dorsal and the forefinger on the plantar surfaces of the third or fourth metatarsal bones. (4) That such is usually quite local, and would not respond to pressure if, as asserted, the pinched and sensitive nerves were placed between the toes. (5) That in most cases a broadened foot, due to collapse of the anterior arch, accompanies the affection, rendering the digital nerves less liable to compression. This fact, in conjunction with another that a broad-soled boot hardly gives any relief to the third degree of plantar neuralgia, is strongly at variance with Morton's theory. (6) That in a large number of cases grasping the foot around the heads of the metatarsal bones, thus approximating them and at the same time raising the arch, relieves the spasm. (7) That frequent flexion of the toes is an instinctive method of relieving spasm, the flexion of the toes being accompanied by the raising of the heads of the metatarsal bones. (8) That manipulations of the foot by the surgeon other than applying direct local pressure rarely produce pain. (9) That frequently beneath the painful head of the bone is to be found a distinct callosity, thus showing that pressure is greatest here. We are of opinion, then, that

clinical observations as well as anatomical facts accord much better with the theory of treading upon than that of pinching the nerve, and are fortified in this opinion by three facts: (a) The proximity to the painful area of the communicating branch of the superficial division of the internal plantar; (b) the collapse of the anterior arch in most of the cases, and (c) the bulk of superincumbent body weight in walking on the toes is borne on the first and fourth toes. It has been stated by Gibney that if the bases of the metatarsal bone be grasped the heads will be separated. But we have not satisfied ourselves that such is the case in the normal foot. While it, therefore, appears that in the case of metatarsalgia about the head of the fourth metatarsal bone the explanation is quite clear, it is somewhat difficult to ascertain the cause when it is situated about the heads of the second and third, and third and fourth. The explanation may be this: that when the transverse arch gives way at the heads of the metatarsal bones, and tight boots continue to be worn, the under-surface of the heads of the metatarsal bones are rubbed, so to speak, over the digital nerves in the effort that the foot makes to accommodate itself during progression to its cramped position, and possibly one head is pushed out of place at the spot where the pressure is greatest, and the digital nerve is compressed between the bone and the sole of the boot. The pain is most marked there; indeed, the existence of corns over that painful spot seems to confirm this idea, and yet in other cases it is frequently noted that there is considerable evidence of osteoarthritis about the heads of the bones, while there can be no doubt that osteophytic outgrowths on the under surface of the metatarsal bones would readily press upon the digital nerves. In one of the cases in which we operated we noticed that the under surface of the fourth metatarsal bone was very much enlarged, being prolonged downward and inward by a distinct process. On these grounds, then, we venture to think that the majority of cases may be explained simply as a pressure neuralgia, and

due to the nerve becoming compressed between the head of the bone and the sole of the foot.

*Pathology.*—So far as the few observations which have been made and recorded are concerned, the only changes which have been noticed have been in a few instances, either some enlargement of or downward projection from the head of the metatarsal bone, together with a well-marked state of neuritis of the digital nerves. We have seen this in two of our cases in an unmistakable degree.

*Diagnosis.*—The difficulty in diagnosing this affection until the characteristic symptoms had been fully recognized were considerable, and now by a large number of practitioners the pain is put down to so-called neuralgia, probably due to cold or to rheumatism or to gout. But as we now know, these conditions have very little, if anything, to do with the affection. It is possible that when, as occurs in some cases of Morton's disease, some redness is present in an interdigital space it might be taken for gout, but a little careful examination will certainly serve to distinguish the two, and the fact that in acute gout there is often considerable constitutional disturbance should at once explain the cause of redness or swelling of the veins. Then, again, the pain of Morton's disease has been confounded hitherto with that arising from flat-foot. Now we take it that the pain of flat-foot is not of the intensely paroxysmal nature of metatarsalgia. It is rather a dull, boring, aching pain; nor when we come to examine such feet is there such a degree of flat-foot present as to suffice to explain the agonizing nature of the pain. It is true we have already said that in many cases of Morton's disease some degree of flat-foot is present, but in our experience that amount of flat-foot which is often seen is quite incapable of producing such serious distress as is occasioned by the plantar neuralgia. Yet, again, in many cases of Morton's disease there is hardly a single trace of posterior flat-foot, although it will be observed that the anterior tarsal arch is somewhat convex below, and there is a certain amount of dull pain about the anterior transverse arch, but patients will tell us that it never has been acute or lancinating

in character, and no doubt this dull pain arises from stretching of the ligaments at the anterior transverse arch, just in the same way as there is a constant dull pain in stretching of the ligaments at the posterior part of the foot. Cases of this description should be carefully distinguished from Morton's disease, since they will soon get well if the flat-foot and ligamentous weakness be treated, and, further, they get well without operation.

*Treatment.*—This varies according as the first, second, or third degree is present.

In the first degree the treatment is largely preventive, and should be carried out on the following lines: (*a*) To abstain from continuing any action which produces the pain. (*b*) To modify the boot so that the foot is inverted. This is readily done by increasing somewhat—that is, about one-eighth to one-quarter of an inch—the depth of the inner aspect of the sole and heel. (*c*) Not to wear thin-soled boots, but thoroughly thick-soled boots, which shall prevent pressure on the tender spot. These boots should have tight-fitting insteps and be roomy around the heads of the metatarsal bones, the object of these details being to prevent the toes being doubled up against the end of the boot and so becoming flexed with corresponding depression of the head of the metatarsal bones. (*d*) That the sole should be at least one-quarter inch thicker a little behind the heads of the metatarsal bones. It is often difficult to adapt this thickening, but it may be done in various ways. Some patients prefer to wear a thickness of cotton wool, which they adjust inside the stocking themselves. Others prefer to have the thickening made in the sole of the boot, while yet others prefer to wear a small cork or india-rubber pad. It will often be noticed that the patients find out for themselves the easiest way of adjusting this.

With regard to the treatment of the second stage, the following measure should be tried in addition to those already enumerated for the first degree. The sole of the boot should be thickened about one-half inch behind the heads of the metatarsal bones. A band of non-irritating plaster may



be worn around the instep, or, better still, a leather anklet should be made which can be laced up along the front so as to obtain the required degree of pressure without interfering with the circulation. Baths of hot and cold water are very useful, and if the pain be acute, it may be allayed by the application of the oleates of belladonna or of morphia. The feet should be kept elevated in bed at night and the parts should be well massaged. If attacks have been very severe, it is well to advise the patient to rest the foot entirely for two or three weeks, the object being to allow the neuritis to subside. Hot and cold bathing and massage being continued, the patient should be allowed to walk about gradually, first of all in-doors, with a boot with thin sole, but when he goes out of doors he should be advised to have the boot made as described above. It must be thick-soled.

In the third degree these measures are found entirely unavailing. The nerve has become chronically inflamed, and unless the cause be removed the pain will still continue, so that the only resource that is left is operation.

The operation *par excellence* is excision of the head of the metatarsal bone at which the pain is situated. As we have before said, in the majority of the cases it is the fourth metatarsal bone. The other operations which have been advocated in practice are excision of the joint, amputation of the toe, and the application of the actual cautery, pushing in a heated needle over the painful site to destroy the nerve, hypodermic injection of carbolic acid. Lastly, resection of the digital plantar nerve. These less measures are uncertain in their action, and, further, they have this disadvantage that in order to reach the nerve the sole of the foot must be interfered with. The simplest measure of all and the best by far is the exsection of the head of the metatarsal bone. It is a very simple operation, and is carried out in the following way: A longitudinal incision is made over the dorsal aspect of the head to be removed. The extensor tendon is divided, and about one-quarter to one-half inch of it should be resected. The capsule of the joint is opened, the head of the bone dissected out by a blunt instrument, and with fine bone-



nippers the head is removed and the flexor tendon below divided. In removing the head of the bone, it is well to take care that on the under aspect of the metatarsal bone there should be left no sharp edge, and at this spot the shaft of the bone should be carefully rounded off. In one of our cases, after operation, the patient experienced some pricking sensation in the sole of the foot. This gradually passed away as the sharp edge was, so to speak, rounded off. The wound is then stitched, and, as a rule, no vessels need securing. The after-treatment consists in keeping the patient in bed about ten days with the foot elevated. The patient may then be allowed to walk with a thickening or a bar behind the head of the metatarsal bone. But if the patient be allowed to continue to walk too soon, the scar does not consolidate firmly, and it may in the case of weak individuals break down.

This operation undoubtedly gives the best results, and we are of opinion that it should be practised in all cases in which the pain cannot be relieved by simpler and palliative measures.

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## THE CRANIAL "CRACKED-POT" SOUND AS A SYMPTOM OF CEREBELLAR TUMORS.<sup>1</sup>

BY NORMAN BRUCE CARSON, M.D.,  
OF ST. LOUIS.

My purpose in presenting the following cases of cerebellar tumors is, in the first place, to add to the literature of the subject cases not heretofore reported, and, in the second place, to call attention to a symptom which, from my experience, seems to have been overlooked or neglected,—namely, the so-called "cranial cracked-pot sound," due to separation of the sutures from internal pressure, caused by the accumulation of fluid in the brain cavities, produced by the closing of the iter or pressure upon the veins of Galen, or both.

CASE I.—E. S., aged six years, good family history, entered the St. Louis Mullanphy Hospital on February 26, 1895. The history given by the parents was that he had always enjoyed good health until about a year before, when he began to suffer from very severe headaches and vomiting. These attacks increased in frequency until they became of almost daily occurrence. During the fall of 1894 he had the measles. This left him in a decidedly bad condition. The general health was unchanged, but the sight failed rapidly, a daily change for the worse being noted. Besides this, he could hardly walk without assistance.

*Physical Examination.*—The intelligence was above the average. One of his teachers told me that he was one of the brightest children in school. His general condition, with the exception of a slightly anæmic look, was that of a fairly well-nourished child of his age.

The head was large and symmetrical, with prominent pari-

<sup>1</sup> Read before the American Surgical Association, April, 1898.

etal and frontal bosses and bulging forehead. The vault of the cranium was not flattened. Upon percussing the head two distinct sounds were produced; one the cranial cracked-pot sound, the other a perfectly clear tympanitic sound. He was perfectly blind with widely dilated pupils, which responded sluggishly to very strong light. Drs. Pollack and Jennings, who made an ophthalmoscopic examination, reported that the media were clear,—optic disks atrophic, with very small arteries and veins. The eyes were so unsteady that it was impossible to study the fundus carefully for post-neuritic changes. None were observed. As to the light which these eye-symptoms throw upon the diagnosis they concluded as follows: There is a partial paralysis of the oculomotor nuclei governing the action of the recti muscles, the pupil and very probably the muscle of accommodation. But from the fact that the pupil reacts to light, though the patient is blind, shows that the optic nerve and tract to the corpora quadrigemina and thence to the oculomotor nuclei, and thence through the oculomotor nerve to the iris are to some extent functionally active, or, in other words, the lesion must be situated in or behind the corpora quadrigemina. The hearing was good, as were the other special senses. There was perfect control of the sphincters, and the reflexes were normal and symmetrical throughout.

On the 28th of February I tapped the ventricles, and drew off about four ounces of normal cerebro-spinal fluid. Death occurred on March 15, 1895.

The post-mortem showed the wound to be perfectly aseptic. There was a small hernia at the trephine opening. Upon percussing the skull, after the scalp was removed, the two sounds were still present, only more marked. The cranial bones were very thin and very hard. The surface of the dura was flecked with whitish bodies or specks, giving it a slightly roughened feeling, while under the dura, over the left occipital region, was an extravasation of blood one by one-and-a-half inches, and about one-eighth of an inch in thickness, evidently the result of the violence inflicted by the chisel during the operation.

Upon removing the brain a large conical cyst (moderately tense), projecting from the upper surface of the cerebellum, was exposed. The right hemisphere was displaced to the right and compressed, and there was a general anæmic condition of the entire brain substance, and a flattening of the convolutions. The

lateral ventricles were greatly distended, while the choroid plexuses were very pale. The foramen of Monro and the Sylvian duct were much enlarged, the latter to the size of a large lead-pencil.

I had seen the patient several times at my office before his entrance into the hospital. When first seen there was nothing to attract attention, except the head, which was quite large, but I was told that it had always been so. The pupils responded normally and the gait was good. Upon percussing the head with the finger two entirely different sounds attracted my attention, one a distinct cracked-pot sound; the other a clear tympanic sound. When I saw him first, after the attack of the measles, the sight was failing and the gait was decidedly cerebellar, the tendency being to fall to the right side. At the same time I noticed a perceptible increase in the size of the head.

CASE II.—L. B. first came under the attention of Dr. Fry October 25, 1897. He was a healthy-looking lad, seven and a half years old. The parents, who accompanied him, stated that he was complaining of severe headache, vomiting frequently, and walking poorly. Their attention had been called to the difficulty in gait, in the last six months especially, but they could remember that since the latter part of September, 1894, he had been clumsy, frequently falling. They had also noticed that for some time past he had been awkward in the use of his hands. They had also been impressed with the peculiarity of his headaches. They came on suddenly, became very intense for a while, then disappeared entirely. The child returning to play, almost as though nothing had happened.

The peculiar vomiting, typically central, had preceded the headache, possibly, two months. This history was presented in an unusually satisfactory manner, both parents being intelligent and very observing persons. The vomiting, headache, and incoordination, especially the latter, were all becoming worse when he came to Dr. Fry.

A physical examination revealed the following points: An ataxic gait, cerebellar type, it could not be determined that, in walking, he would move more to one side than the other. His head, however, was always inclined to the right shoulder. Both parents affirmed that they had noticed this for some time past. Slight pains of the left side, especially of the upper extremity,

seemed to be present. No sensory symptoms were recorded. Percussion of the head brought out clearly the cracked-pot sound. The parents could not affirm that there was any increase in the size of the child's head; he had always had a good-sized head. There was probably, from parents' statement, some degree of mental hebetude, but he answered questions promptly and intelligently, and was very amiable and cheerful in disposition.

An examination of the eyes showed a well-advanced optic neuritis and swollen disks. A few days' observation established the fact that pressure symptoms were rapidly increasing. The situation was explained to the parents, and they decided to accept an operation, and he was sent to the Missouri Baptist Sanitarium, where, on the 11th of November, I operated. The trephine was applied over the right cerebellum, as near the median line as possible. The patient took the chloroform badly, and at one time the operation had to be suspended for a while, while means were taken to resuscitate him. After exposing a considerable area of the cerebellum, I was convinced that it did not give a normal resistance to the touch. The convolutions were gently separated and the finger introduced to the distance of about a half inch. I felt quite certain of an abnormal resistance. By pushing the convolutions gently aside, I exposed this point clearly to the view, and while it had distinctly the feeling of a pathological condition, to the sight it resembled so closely normal brain tissue that it was impossible to differentiate. The child's condition at this time was so bad that I decided to defer further investigation. He was returned to bed at 12.15 o'clock, and died at 2 P.M.

At 4 P.M. the post-mortem was made. The cranial bones were thin; and separated at the sutures, the skull-cap was raised with difficulty, being firmly held in many places by trabeculae of the dura, which projected into the sutures. The convolutions were pale and oedematous. The whole brain was quite oedematous. The ventricles were much distended with a large quantity of normal-looking cerebro-spinal fluid. In the right lobe of the cerebellum was found a large glioma, which occupied its central and mesial portions and the greater part of the superior venna.

The corpora quadrigemina were the site of another deposit

of the same nature, and several small foci were found on the ependema of the ventricle.

CASE III.—In 1897, Dr. Fry presented to his clinic a negro lad, of fourteen years, with all the symptoms of a cerebellar tumor. The head was much distended. The cracked-pot sound was very plain. Later he entered the City Hospital, where he died. On autopsy a large cyst was found in the upper surface of the cerebellum.

CASE IV.—In 1896, Dr. Fry presented a lad, of twelve years, with a diagnosis of tumor of the cerebellum, to the St. Louis City Hospital Medical Society, where he was carefully examined by a number of those present. In this case the cracked-pot sound was very marked, being audible at a considerable distance. The head did not appear abnormally large, and the mother did not think that there had been an increase in its size. The child was afterwards taken to another State and passed from our observation, and thus the opportunity for verification of our diagnosis was lost. The symptoms, however, were so classical as to leave little doubt as to its correctness.

We have here four cases of cerebellar tumors diagnosed, in three of which the diagnosis was confirmed by post-mortem, in which this cracked-pot sound was present. This sound is due to a separation of the sutures, and therefore is not evident, except in those cases where the sutures are not widely separated. It is on that account apparent only in cases where the sutures have been united and again separated by pressure from within, as in cases of acquired hydrocephalus, and never in the congenital form. The only other condition wherein I have found this sound present is in extensive linear fractures of the skull.

The cranial cracked-pot sound must not be mistaken for the high-pitched sounds present in some cases of brain tumors, as it is not a high-pitched sound, but the clear, distinct, cracked sound produced by striking a cracked pitcher or iron pot, and is best made by percussing the cranial bones with the finger instead of with a pleximeter.

It is not necessarily a sound of childhood either, but may be present at any period after the sutures have become firmly



united. Dr. L. Bremer recently showed me the skull of an adult patient who had been the subject of a cerebellar tumor, causing hydrocephalus, in which the separations of the sutures caused by the internal pressure were beautifully demonstrated, and showing conclusively that this separation may take place in adults as well as in young persons. In this case the cracked-pot sound was not made out before death, because it was not sought. I have no doubt, however, from the condition of the sutures that it was present.

Gowers<sup>1</sup> says the separation of the sutures does not involve such great force as may be supposed, for the reason given by Hale White,—namely, that tumors of the brain cause a remarkable thinning of the cranial bones. This applies especially to cerebellar tumors, and that on this account a very slight force only is needed to produce a separation of the sutures. From this we may conclude that a very slight pressure from within might produce a separation of the sutures and the production of the cracked-pot sound comparatively early in the disease, especially in the case of children, who, as we all know, are often the subjects of cerebellar tumors.

In an analysis of forty-nine cases of cerebellar tumors, I found mention made of the presence of hydrocephalus in twenty-two of them, so that with hydrocephalus present in such a large percentage of these cases, this sound must be an important symptom, as my researches lead me to the conclusion that it is to be detected in all cases where the ventricular effusion is sufficient to exert actual pressure.

That hydrocephalus is not always easily diagnosed is evident from the number of cases reported in which its presence was not discovered until the post-mortem. Roswell Parke<sup>2</sup> says, "The diagnosis of hydrocephalus can only be positively made when the shape of the skull is changed to accommodate the increase of the fluid within." In two of the cases mentioned above there was no apparent increase in the size of the head, yet the presence of this sound indicated the pressure from within. So that with this sound present I think we can surely diagnose hydrocephalus, and with the



other symptoms of brain tumor we can locate it either in the cerebellum or in the neighborhood of the corpora quadrigemina.

In an examination of the literature I find mention made of the cranial cracked-pot sound but twice,<sup>3</sup> once by Keen,<sup>4</sup> where he refers to it as a symptom in cases of acquired hydrocephalus, again by Hall,<sup>5</sup> who mentions its presence in a case of cerebellar tumor causing hydrocephalus. From this I am led to the conclusion that this symptom, which I think one of considerable importance, has been overlooked, as it seems to me that if it had been noticed, reference to it would certainly be more frequent.

Since my return from New Orleans I find in a work, "Die Geschwülste des Nervensystems," von Dr. Ludwig Bruns, Berlin, 1897, mention is made of the cracked-pot sound in cerebellar tumors.

He says he does not consider this sound as pathognomonic of cerebellar tumors. He further says that he considers it pathognomonic only of a local or general thinning of the cranial bones, which naturally does not occur alone in tumors, and is therefore not apt to have any pathological significance before the third year, or before the complete closure of the fontanelles. Besides, he finds it in hydrocephalus and acute tubercular meningitis.

Macewan, "Diseases of the Brain and Spinal Cord," says he has met with this sound in three cases of extensive fractures of the cranium.

With the statement that this sound is not pathognomonic of tumors, I have had many opportunities of demonstrating, not only in cases of acquired hydrocephalus from other causes than tumors (indeed, I see almost daily at present a case of hydrocephalus, not due to tumor, in which the bruit de pot fêlé is present), but also in cases of fractures of the skull. Nevertheless, I do hold that with other symptoms of tumor present it is not only an important factor in the diagnosis, but in the localization as well.

With the statement that it has no pathological signifi-

cance before the third year or before the complete closure of the fontanelles, I also fully agree, as I have never been able to produce the sound from the heads of healthy children either before or after the age of three years, nor have I been able to get it from any of the several cases of congenital hydrocephalus that I have examined.

## BIBLIOGRAPHY.

<sup>1</sup> Diseases of the Nervous System.

<sup>2</sup> Dennis's System of Surgery.

<sup>3</sup> Dr. Keen called my attention, after the reading of this paper, to a case of fracture of the skull reported by him in the *American Journal of the Medical Sciences*, October, 1888, in which the patient had heard this cracked-pot sound upon percussing his skull after the receipt of the injury. I first noticed this sound in April, 1877, in a case of fracture of the skull in a lady injured in the Southern Hotel fire.

<sup>4</sup> American Text-Book of Surgery.

<sup>5</sup> London Press and Circular, N. S., Vol. lxi, 1896, p. 497.

REPORT OF A CASE OF TRAUMATIC RUPTURE  
OF PANCREAS, WITH FORMATION OF  
HÆMORRHAGIC CYST, AND PAN-  
CREATIC FISTULA.<sup>1</sup>

BY HAYWARD WARREN CUSHING, M.D.,

OF BOSTON,

SURGEON TO THE BOSTON CITY HOSPITAL.

I HAVE found very few published reports of recovery after crushing and rupture of the pancreas. Opportunities to investigate the pancreatic secretion in cases of pancreatic fistulæ in the human subject are also very rare. The clinical symptoms which indicate a pancreatic lesion are not so well known, but that its diagnosis is still difficult and uncertain. Positive knowledge of its physiological processes is limited. I therefore present the following record, hoping it may be of interest.

About December 9, 1896, a well-developed, medium-sized man, aged thirty-one years, whose hereditary and previous history indicated a perfectly well person, was injured as follows: About 5 P.M., while at work in a piano-factory, he was struck in the epigastric region by the end of a board. This board was four feet long, nine inches wide, and one inch thick. It fell accidentally upon a rapidly revolving circular saw, and was thrown violently against the patient. The result was a sudden violent blow in the epigastrium five hours after eating. He fell on the floor. Did not quite lose consciousness, but felt great depression, faintness, pain, and distress.<sup>1</sup> He was removed to his home in a carriage. Distress and severe pain in epigastrium continued. He did not

<sup>1</sup> Read before the American Surgical Association, Thursday, April 21, 1898.

go to bed till 11 P.M., at which time he vomited profusely. The vomitus was described as containing dark, clotted blood in considerable amount. This (hæmatemesis) occurred once on the next day, but not afterwards. He remained in bed one week, during which time the epigastric pain and nausea continued. It was increased by food. Food also caused vomiting. No defecation without cathartics. At the end of the week he attempted to get up, as the symptoms were then somewhat relieved, and go about; but at the end of three days the recurring vomiting, discomfort, and epigastric pain again forced him to go to bed. The vomitus was greenish; the pain throbbing in character. A few days later another attempt was made to get up, but the pain, vomiting, and distress soon obliged him to return to bed. Two weeks after the injury a painful, pulsating, somewhat tender tumor in the right epigastrium was noticed, which increased rapidly in size.

No especial constitutional disturbance was reported. There were no thoracic symptoms. The dejecta and urine did not attract attention.

The next event noted (about January 7, 1897) was pain, tenderness, and marked swelling in the left parotid region with dysphagia. A few days later the right parotid became swollen, painful, and tender, but not so much so as the left.

This state of affairs continued till January 9, 1897, when the writer first saw the patient. The symptoms were still throbbing epigastric pain,<sup>2</sup> pain in lumbar region, and vomiting. Micturition was somewhat painful. No defecation for three days. The face showed some emaciation. The expression was somewhat anxious. Temperature 100.2° F.; pulse 114. Tongue dry with rather thick brown coat. The left parotid gland was considerably swollen and tender. The right parotid was similarly affected, but to a less degree. There was dysphagia; thorax, negative. Abdomen: There was a slight, recently-healed, apparently superficial wound over tip of the ninth right costal cartilage, probably made by one corner of the board. In the epigastric region the surface was slightly elevated, especially to right of linea alba. The swelling extended into the left hypochondrium. About the middle third of the distance from the xiphoid cartilage to the umbilicus was an area which visibly pul-

sated. It was rather resonant with light percussion, but flat when percussed more forcibly.

It was somewhat resistant to palpation, and a smooth elastic mass was felt, whose exact outline could not be determined. It was not movable with gentle manipulation. It was somewhat tender. It pulsated distinctly, and the pulsation was apparently expansile. Its size was about three inches vertically and four and a half inches horizontally. Auscultation was negative. Pulsation in the femoral arteries, at Poupart's ligament, was equal, synchronous, and apparently not delayed. The hepatic dulness extended in front below the right costal border. Abdomen otherwise normal. The examination of the urine was negative.

The most probable explanation of the patient's condition seemed to be that the abdominal wall, when struck, had yielded, allowing the contents of the abdomen at the point of impact to be crushed between the end of the board and the spine. Its elasticity saved it from injury except the slight superficial wound above described. The bloody vomitus was thought to indicate a contusion of the stomach. The throbbing epigastric pain, the epigastric tumor first noticed two weeks after the injury, increasing in size, with its apparent expansile pulsation, both seen and felt; its smooth elastic surface and flat percussion note seemed to indicate a traumatic aneurism of some branch of the cœliac axis. There was no satisfactory explanation for the condition of the parotid glands.

After a careful consideration of the case it was thought most judicious to watch the effect of conservative treatment.<sup>3</sup> This was done for one week (until January 16). During this time the patient's general condition improved. The tongue became cleaner, the temperature normal, pulse 85 to 98. The swelling of the parotids was diminished and the dysphagia had disappeared. But the abdominal subjective symptoms were unchanged. The epigastric pain continued to be variable. It was more marked with dorsal decubitus and after eating. It was still throbbing in character. The tenderness was unchanged.

Food by mouth had to be discontinued on January 11, on account of the pain and vomiting caused by it, and the patient was fed by enemata. The condition of the abdomen had altered. The recti muscles were more tense. The tumor had increased (Fig. 1, 3) in size. The swelling in the right epigastric region

was now plainly visible. The area of flatness on deep percussion was increasing and changing in contour. The tumor moved with respiration. The pulsation was less marked. The superficial inferior epigastric veins had become dilated.

Briefly, although the patient's general condition and parotid complication were improved, the abdominal symptoms were not relieved. The tumor was rapidly increasing in size, and threatened to endanger the patient's life. Rectal feeding was not a

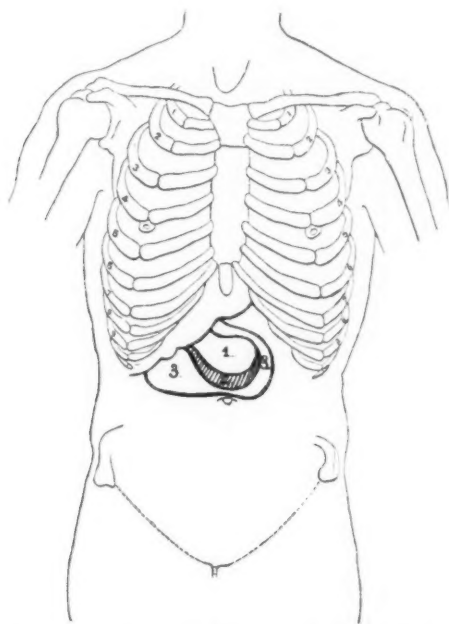


FIG. 1.—1, area of flatness, January 9; 2, area of flatness, January 10; 3, area of flatness, January 15.

satisfactory manner of nourishing a patient critically ill. The patient earnestly requested operative treatment. An operation was therefore decided upon and performed on January 16, thirty-eight days after the injury.

*Operation.*—The abdomen was opened in the median line.<sup>4</sup> The transverse colon and omentum appeared. The colon appeared to lie superficially to the tumor, which was about five inches in diameter. In order to locate it more definitely, an attempt was made to raise the great omentum. This showed some ecchy-

motie areas and was quite adherent. It was separated with great difficulty, and when raised exposed the tumor bulging out below the transverse colon,—dark reddish blue in color and fluctuating. On account of its site when first noticed, and its present position, a vertical incision was made between the stomach and transverse colon, apparently into the cavity of the lesser omentum. A large quantity of fluid escaped (at first clear, watery, and straw-

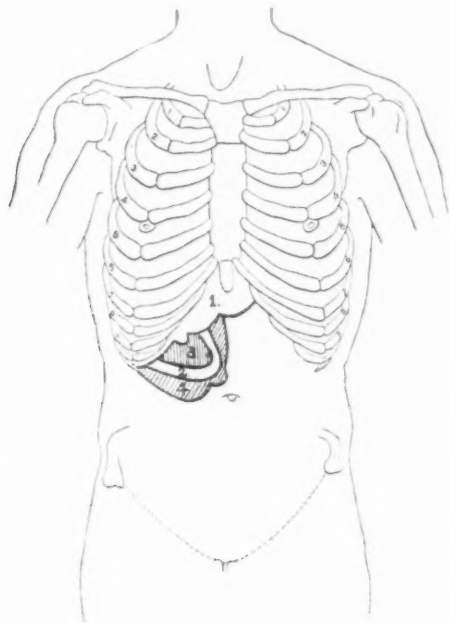


FIG. 2.—1, area of dulness, February 7; 2, area of dulness, February 8; 3, area of dulness, February 13; 4, area of dulness, February 20; 5, area of dulness, February 21 (same as 2); 6, area of dulness, February 23 (same as 3).

colored; later stained reddish brown), leaving an irregular cyst-like cavity five inches in its antero-posterior diameter. On digital examination the finger came directly upon the aorta, showing that the fluid was retroperitoneal and not in the cavity of the lesser omentum. A little below a somewhat granular, rather firm mass was felt, resembling in position and outline the pancreas. To the right of the median line, towards the duodenum, was a ragged irregular cleft which readily admitted the finger,

but the depth of the cavity and the blood present prevented its being actually seen. No vessel sufficiently large to require ligation was seen. The operation had apparently demonstrated a wound or rupture of the pancreas near the omental tubercle and not an aneurism. The patient's condition was now such that it was unsafe to prolong the operation. It was therefore finished as rapidly as possible. The cavity was packed with iodoform gauze to control hæmorrhage and provide drainage. The edges of the wound in the omentum, between the stomach and the colon, were sutured to the edges of the parietal peritoneum, thus closing off the general peritoneal cavity. The abdominal wound was closed by silk sutures, except at point of emergence of gauze strips, and was dressed with a large sterile gauze dressing, sheet cotton, and swathe. The duration of the operation was an hour. Considerable shock followed.

*January 17.*—Patient weak, slight vomiting. Profuse sero-sanguinolent discharge from the wound, which necessitated a new dressing six to eight hours after the operation. Cough. Respiration 36; temperature 102.4° F.; pulse 129. Rectal feeding.

*January 18.*—Much worse. Condition alarming, due apparently to an abscess which fortunately was evacuated spontaneously through a bronchus.<sup>5</sup> The discharge from the wound was so profuse as to saturate completely a sterile gauze and cotton dressing, large enough to cover the abdomen and three inches thick, once in eight hours.

*January 19.*—From this point patient began to improve. He gained strength rapidly. On January 20 the temperature, pulse, and respiration were comparatively normal. Vomiting had ceased and feeding by mouth was begun. On January 22 (six days after operation) the patient was eating selected solid food. The expectoration was slight only on January 21 and ceased on January 25. The cough was slight on January 21 and ceased on January 29. The physical signs in the right chest also rapidly and entirely disappeared. The condition of the parotids steadily improved, the tenderness disappeared, the swelling diminished gradually. On February 13 the right was normal. The left showed only an indurated mass, one inch long, subjacent to the angle of the jaw, which soon disappeared. The operation wound healed rapidly to the point of drainage. In spite of fre-



quent dressings and the profuse discharge it was kept almost entirely free from suppuration. The peritoneal edges united firmly, shutting off the general peritoneal cavity. The packing of iodoform gauze was removed on January 21, and replaced by sterile gauze strips. The sutures were removed on January 24. The cavity of the cyst rapidly contracted. From a diameter of five inches at the time of the operation, on January 29, its capacity was barely eight cubic centimetres, and on February 6 it was a sinus (four centimetres long and one-half centimetre in diameter) in which a drainage-tube was retained with difficulty. On February 12 the tube was discontinued. The patient sat up on February 11 and walked on February 13; was dressed and about on February 18; and on April 15, 1897, eighty-eight days after the operation, returned to work and his former daily life.<sup>6</sup>

From January 26 to March 1 the temperature was practically normal. The pulse averaged 95 to 100 till February 24, then ranged between 90 and 80. The respiration was 25 as long as it was recorded (March 3).

The above facts complete the history of the case except in one particular which is unusual and interesting.

It was noticed at once, after the operation, that the amount of discharge from the wound was excessive, at first like bloody serum, but in a day or two clear. On January 21 the skin in the vicinity of the wound showed distinct signs of irritation. The itching and burning caused marked discomfort. The iodoform gauze (a possible cause) was therefore discontinued, but without relief. The condition increased so that on January 24 the entire upper abdominal and lower thoracic regions were denuded of epidermis, as if removed by erosion. Wherever the discharge came in contact with the unprotected skin it caused great itching, burning, and smarting, and rapidly removed the epidermis. The most probable explanation of this excessively irritating discharge was that it was pancreatic secretion, and efforts were made to establish its identity. The information at the writer's disposal and his own knowledge, based wholly on general pancreatic literature, led him to expect that in affections of this organ the clinical picture would show rapid emaciation, frequent dejections containing much undigested fat, starch, and some muscle-fibre, a dirty, yellow-pale skin, and sugar in the urine. Normal active pancreatic fluid is described as a slightly turbid, somewhat viscid

fluid, which resembles saliva, frothing on agitation, distinctly alkaline. Specific gravity 1030. Albumen, as an alkaline albumen, sometimes leucine or tyrosine. It should emulsify fats, digest proteids or fibrins, and transform starch to glucose. Its amount in twenty-four hours about 300 to 400 cubic centimetres. That in pancreatic fistulæ in animals the secretion soon loses its specific characteristics. Now the discharge from this patient was profuse, and, if pancreatic fluid, it seemed probable that most of the total amount must have escaped and been unavailable for digestion. It thereupon seemed probable that this deficiency would soon show itself and the prognosis for the patient under such conditions be a grave one. But with the above this history did not correspond. At first there was considerable emaciation, but after January 25 this rapidly disappeared. It would have been strange if it had not occurred even had there been no deficiency of pancreatic digestion. A severe injury, several weeks of suffering, a severe operation, and a pulmonary or subphrenic abscess would easily cause it. The urine never contained sugar.<sup>7</sup> There was no diarrhoea. The fæces were practically normal, or at least showed only slight intestinal irritation. There was no starch in any amount, only a small amount of fat, some undigested muscle-fibre, epithelial cells, detritus, and pus (microscopically only). The patient was not especially pale or yellow. So that, as far as the patient's general condition or digestive processes were concerned, this profuse loss of secretion appeared to have no effect. The examination of the fluid previous to February 6 did not positively demonstrate that the fluid was from the pancreas, the physiological reactions being negative, although it resembled it in several other particulars.<sup>8</sup>

It was not till February 6, when, with the valuable co-operation of Dr. Franz Pfaff,<sup>9</sup> a more careful and extended examination was begun, that the fluid was shown beyond doubt to be pancreatic. This showed conclusively that the fistula was connected with the pancreas.<sup>10</sup>

The local conditions up to this time were epigastric tenderness and pain on stooping. The abdomen was normal in contour with no induration. An area of dulness which varied (see Fig. 2) subsequently and the extensive erosion of the epidermis from the discharge. The discharge from the sinus was continual, drop by drop. It was most rapid about three hours after eating,

and diminished during the night. Total amount in twenty-four hours still large. The area of dulness steadily diminished till February 20, then suddenly increased considerably. (Fig. 2, 4.) This was immediately preceded by a marked diminution in the amount of discharge from the sinus. The next day the discharge began to flow again, and the dulness steadily diminished. On March 1 it was absent.

On February 21, by means of a "Pegram" tube,<sup>11</sup> the sinus was so drained that almost the entire amount of the discharge could be collected and the patient kept quite dry. This furnished a satisfactory opportunity to estimate the rate of flow, and an abundant supply of fluid for examination. It was a most efficient way for controlling the sinus. It was worn until the discharge had almost ceased, on March 31, when it was removed. The remaining sinus healed in four days (April 4), seventy-seven days after the operation. From this time, except for some epigastric tenderness and pain on stooping, due probably to pressure on the pancreas, the patient was well.

The subsequent history to the present time, March, 1898, is that the case has done well. A ventral hernia at the site of the operation wound, due to a separation of the recti muscles, was noticed on April 23, 1897, and is still present, requiring a truss bandage. There is at times some pain deep in the abdomen, under the tip of the right twelfth rib. There is no functional disturbance of the alimentary canal. With the exception of the hernia the abdominal examination is at present negative. The patient's general condition is excellent.

Cases of pancreatic fistulæ have occurred. I have not been able to make any special addition to the extensive bibliography of pancreatic lesions published by Professor Senn.<sup>12</sup> I have been able to collect from the literature of the pancreas only nine cases whose character is of interest here. Four<sup>13</sup> died at once from multiple injuries, the pancreas being extensively crushed. Two<sup>14</sup> were cases of cysts caused by traumatism (a crushing injury or a blow) and three<sup>15</sup> cysts with no history of injury. Of the five cysts, all were operated upon. All recovered. In all fistulæ resulted. In three the fistulæ healed in two to four months. In two I am ignorant

of the final result. In none were any investigations reported except the tests to show the character of the fluid. Neither Dr. Pfaff nor I know of any other case except the one now reported in which observations have been made to establish the daily amount of the secretion of the pancreas. I will not

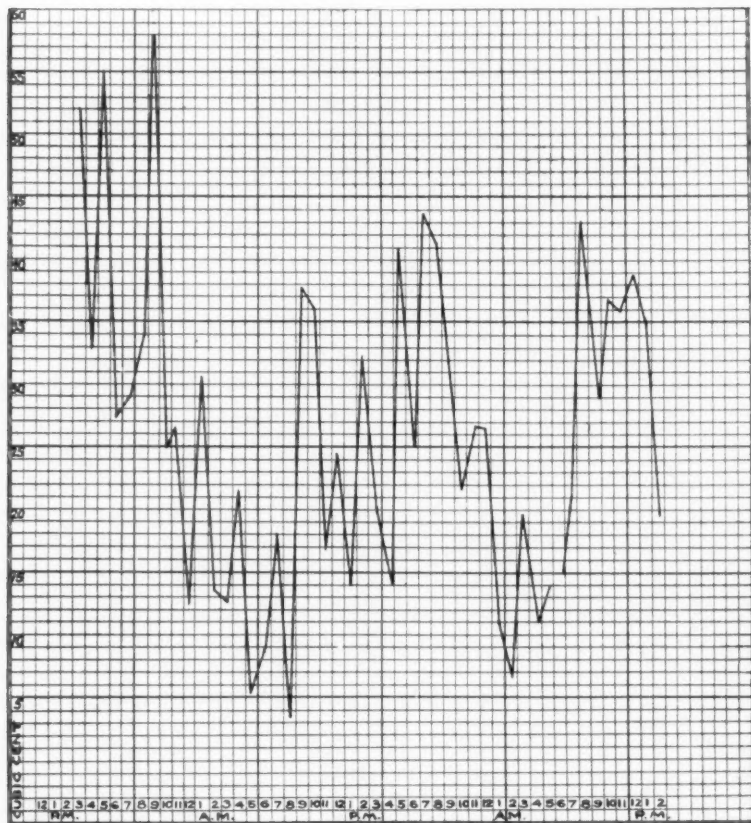


FIG. 3 —Pancreatic curve.

delay here to describe Dr. Pfaff's extensive and valuable work which he has in part already published.<sup>10</sup> I will only briefly state a few results.

He found that the fluid, when fresh, gave promptly the three physiological reactions, which established its identity

without doubt. By means of the "Pegram" tube probably not more than fifteen to twenty cubic centimetres of the fluid from the fistula were lost in twenty-four hours, so that fairly accurate continuous measurement by hours could be made. By making such measurements continuously for forty-eight hours it was possible to form a curve showing the rate of secretion and the effect of food on glandular activity. This curve shows variations between six and sixty cubic centimetres in the amount of secretion per hour, the maximum amount being in the daytime during digestion, and the mini-

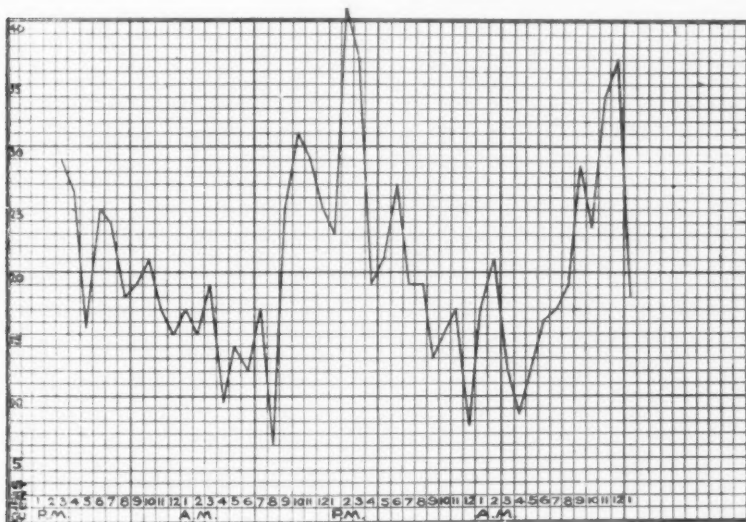


FIG. 4.—Biliary curve.

mum during the night. The variations correspond to those of the biliary secretion. This is shown by this curve, which was also compiled by Dr. Pfaff, in a similar manner, from observations made by him on a patient with a biliary fistula and complete occlusion of the common bile-duct. The total daily amount of pancreatic secretion was measured for thirty-three days. The amount usually stated in text-books of physiology (which is based mostly on the results of experiments on animals) is 250 to 350 cubic centimetres in twenty-four hours.

For eight consecutive days the total daily amount from this patient was found to be 500 to 660 cubic centimetres, or double the above. Also it was noted that although the patient ate a mixed diet and that daily over 600 cubic centimetres escaped from the fistula, still the fæces were normal in character and amount, and no excess of fat or starch in any quantity could be detected. Therefore part of the pancreatic secretion, enough to carry on digestion, must have passed into the intestine, and the fistula was an incomplete one. When, in addition to the above amount, one remembers that 500 to 600 cubic centimetres of fluid were collected daily from the fistula, it would seem to indicate that the capability of the pancreas for the secretion of digestive fluid is much greater than has been heretofore assumed by physiologists.

At first the urine was considerably increased in amount.<sup>17</sup> There was no sugar or albumen. Later the amount varied between 1350 cubic centimetres (forty-five ounces) and 1800 cubic centimetres (sixty ounces), being normal in other respects. This condition was probably due to the increased metabolism while the patient was improving rapidly during convalescence.

When one reviews the above case, certain features attract attention.

(1) *Diagnosis*.—What does this record show which indicates a lesion of the pancreas? It shows that when a blow or crush is received in the epigastrium, followed by continued epigastric pain, increased by food, vomiting, and the appearance of a tumor which at first is situated over some part of the pancreas, which grows rapidly, which percussion or inflation of the stomach and transverse colon shows to be subjacent to these viscera, it is probably a case of injury to the pancreas. The tumor may pulsate, and it may, when large, move with respiration. If there is present from wound or fistula an alkaline fluid which digests the epidermis and which gives the three characteristic physiological reactions with starch, blood fibrin and neutral fats, its source is the pancreas. The absence of starch or fat in the fæces in abnormal

amounts, or of sugar in the urine, does not show that the pancreas is unaffected. Such a tumor as was present in this case must be distinguished from an abdominal aneurism, pyo- or hydronephrosis, echinococcus cyst, a cyst of the suprarenal capsule.

(2) How can one explain the affection of the parotids? I do not know. It is stated by Grieg Smith,<sup>18</sup> Paget,<sup>19</sup> Goodell,<sup>20</sup> Keith,<sup>21</sup> Bumm,<sup>22</sup> Bougarel,<sup>23</sup> *et alii*, that after injuries and operations on the abdominal organs in a small proportion of cases a non-suppurative parotiditis occurs, which is attributed to reflex irritation or "sympathy" in some way. The idea is theoretical only. Another possibility, suggested to me by the normal action of the parotid secretion on starch, and which is similar (though less in degree) in this respect to the action of the pancreatic fluid, is that the parotid enlargement was the result of an attempt at vicarious function on the part of that gland.

(3) Was there any connection between the injury to the pancreas and the torticollis which was noticed almost immediately after the injury, and which lasted forty-eight hours. After considerable investigation I am unable to give a positive answer. It may have occurred from a sudden muscular action or wrench of the neck at the time of the injury, and was wholly unconnected with the pancreatic lesion. Muscular spasm, aside from distinct local causes, accompanied by pain, usually indicates nerve-irritation at some point in the nerve-trunk supplying the affected muscles. One, therefore, seeks a nervous connection between these cervical muscles and the seat of primary injury in the epigastrium. These are the phrenic, pneumogastric, and sympathetic. I am unable to demonstrate definitely any such nervous connection, and cannot therefore explain the condition as a case of reflex nerve irritation.

(4) What was the cause of the abscess which evacuated itself through the lung just after the operation. The physical signs in the right chest enable one to eliminate an empyema, unless quite circumscribed. There remains to consider a pul-



monary or subphrenic abscess, and when one considers that the stomach was probably injured (vomiting of blood after injury, etc.) the site of the blow, the absence of symptom of lung irritation (cough, expectoration, etc.) till the abscess was evacuated, and the depressed liver, it seems more probable that the infection had its origin from the wound of the stomach, and that the collection of pus originated below the diaphragm. It was a very dangerous complication which had a very fortunate ending.

(5) The erosive action of the pancreatic fluid on the skin. It was striking as a diagnostic characteristic of pancreatic fluid. The patient was especially interested in finding something to check its action and prevent it from skinning him alive. It caused him more discomfort than any other thing, the pancreatic lesion even included.<sup>24</sup> It is hard to understand why the fluid digests epidermis and not granulation tissue or peritoneum. The most plausible explanation that I know is that the latter are living vascular tissues, while the epidermis is composed of cells with practically no vitality.

(6) Before concluding, I wish to allude to the method of drainage of the pancreatic fistula, which was finally employed, and was of such striking efficiency as to deserve mention. This was the Pegram tube, already alluded to. After it was inserted the patient was kept nearly dry. Almost all the fluid from the fistula could be easily collected and prevented from coming in contact with the patient's skin or the dressing. Similar tubes can be adapted to other varieties of fistulæ to advantage. It has been used with success with biliary fistulæ, and for such a fistula it was originally devised.

(7) By comparing the daily amount of fluid from the fistula with the clinical symptoms, it was noted that on three occasions, when the amount of discharge diminished to any degree, and especially when the fistula finally closed, there were symptoms of intestinal irritation shown by discomfort, gas, and frequent loose dejections (three to four in twenty-four hours) containing mucus.

(8) An unusual appetite or craving for bread was present



for a time. Also for a few days after the operation a marked desire for acids.

## BIBLIOGRAPHY.

<sup>1</sup> Shortly after the injury he had great pain in right cervical region, and head was drawn to right. This condition of torticollis lasted for two days, caused great discomfort, and then completely disappeared. Severe pain was also felt shortly after the injury in the left chest, over the cardiac area. This lasted six to seven hours.

<sup>2</sup> The pain was more or less constant, worse after eating, and increased by motion. When at rest the patient was fairly comfortable.

<sup>3</sup> Rest in bed, careful feeding, hot fomentations to abdomen and parotids, symptomatic treatment of subjective symptoms with drugs indicated.

<sup>4</sup> The incision in the linea alba, five inches long, which passed the umbilicus slightly to the left, and extended four inches above and one inch below it.

<sup>5</sup> This diagnosis was made from the following symptoms: The temperature, pulse, and respiration-curves. A severe cough. Sudden expectoration of a large amount of foul-smelling muco-purulent expectoration. Hepatic area of dullness lower than normal. Dullness in lower right chest with diminished respiration, vocal resonance, fremitus, and coarse moist râles. In the above area a smaller area at the base of the lung, two inches by three inches, which was flat, with respiration, voice-sounds, and fremitus nearly absent.

	1897.	Day.	Temperature.		Pulse.		Respiration.	
			A.M.	P.M.	A.M.	P.M.	A.M.	P.M.
January	10	2	100.4	99.4	115	110		
"	11	3	99.6	99.6	98	119		
"	12	4	99.4	99.4	100	98		
"	13	5	99.5	100.	95	94		
"	14	6	98.	98.2	95	98		
"	15	7	98.4	98.	98	84		
"	16	8	97.8	100.2	86	120	Operation.	
"	17	9	98.	102.4	119	122		
"	18	10	98.	103.4	118	122		36
"	19	11	98.2	98.2	118	105	35	25
"	20	12	98.2	98.5	115	108	20	25
"	21	13	98.5	99.2	97	105	21	24
"	22	14	99.	99.2	100	90	24	23
"	23	15	99.	98.	94	102	23	24
"	24	16	98.6	98.	92	102	24	26
"	25	17	98.	98.	96	106	25	22
"	26	18	98.2	99.	96	104	25	23

<sup>7</sup> There is no record previous to the time when the writer first saw the patient (thirty-one days after the injury), but frequent examinations after that were always negative.

<sup>8</sup> Summary of analyses made at the Pathological Laboratory of Boston City Hospital, with the assistance of Drs. J. B. Ogden, F. B. Mallory, and S. T. Leary. Amount in twenty-four hours not known.

quite large. Five hundred cubic centimetres at least. Color, slightly turbid, like saliva or watery solution of white of egg; clear after filtration like water. Strongly alkaline. Specific gravity 1011. Flows rather freely. Slightly viscid; froths easily on agitation. Odor: None or slight, resembling an alkaline hydrate. Chlorides: Slightly diminished as compared with urine. Albumen. Proteid:  $\text{HNO}_3$  test,  $\frac{1}{8}$  per cent., approximately, consists chiefly of albumose pptd. by  $(\text{NH}_4)_2\text{SO}_4$  saturated solution. Serum albumen: Heat test, very slight trace. Peptones, none. Serum globulin, none. Albuminates, acid, none; alkaline, none. Sugar, none, Fehling's solution and other tests. Bile, none. Digestive tests, fibrin, negative; starch, negative; fat, negative. Sediment considerable (forms on standing by coagulation of a partly amorphous material), contains some leucocytes and few blood-globules, some small, round, fatty degenerated cells, slightly larger than blood-corpuscles. No pancreatic cells. Above probably from tissue during process of healing, —i.e., operation wound.

<sup>9</sup> Pharmacological Laboratory of the Harvard Medical School.

<sup>10</sup> Dr. Pfaff's analysis of the fluid was: Amount, 500 to 660 cubic centimetres in twenty-four hours. Color: Watery solution of white of egg, opalescent, strongly alkaline. Specific gravity 1011. Sediment, very slight, no definite organic elements. Boiling produced flocculi of coagulated proteids. Starch was changed to glucose. Neutral fats were split into fat acids and glycerine. Blood fibrin was digested with formation of peptones. The action of the ferments was quite marked with the fresh fluid.

<sup>11</sup> An appliance devised by Dr. John C. Pegram, Jr., for permanent drainage of a biliary fistula. It consists of a rubber tube with rather rigid walls having the diameter a little less than the diameter of the fistula. One to two inches of that portion of the tube which is just internal to the skin is increased in diameter by covering it with a section of a larger tube. To fit this tube the sinus is dilated, and the tube inserted until the increased diameter is just inside the skin. In a few days the orifice of the sinus contracts firmly about the tube and holds it in place. By a section of glass tube the Pegram tube can be connected with a rubber tube and the discharge from the fistula drained into a bottle. It is an efficient means of draining a fistula when it is necessary to protect the skin or a dressing from the discharge.

<sup>12</sup> Reference Hand-Book of the Medical Sciences, Vol. v, p. 488.

<sup>13</sup> Travers, *Lancet*, 1827, Vol. xii, p. 384; Störck, *Annus Medicus*, 1836; Cooper, *Lancet*, 1839, Vol. i, p. 486; Clark, *Lectures on the Principles of Surgical Diagnosis*, 1870, p. 298.

<sup>14</sup> Senn, *Journal of the American Medical Association*, 1885; Kulenkampff, *Berliner klinische Wochenschrift*, 1882.

<sup>15</sup> Gussenbauer, *Archiv für klinische Chirurgie*, Vol. xxix, p. 355; Thiersch, *Berliner klinische Wochenschrift*, 1881; Kramer and Hahn, *Centralblatt für Chirurgie*, 1885.

<sup>16</sup> *Science*, June 11, 1897; *Journal of the Boston Society of Medical Sciences*, November, 1897.

<sup>17</sup> February 24, 1897, 2400 cubic centimetres; specific gravity, 1014; U + 61.3; N., 26.4. February 25, 1897, 330 cubic centimetres; specific gravity, 1015; U + 63.3; N., 26.7. March 9, 1897, 1880 cubic centimetres; specific gravity, 1016; U + 40.8; N., 18.07.

<sup>18</sup> J. Grieg Smith, *Abdominal Surgery*, p. 98 and Bibliography.

<sup>19</sup> Paget, *Lancet*, 1886, p. 86.

<sup>20</sup> Goodell, *Transactions of the American Gynæcological Society*, 1886, Vol. x, p. 211.

<sup>21</sup> Keith, *Edinburgh Medical Journal*, 1886, Vol. xxxii, p. 306.

<sup>22</sup> Bumm, *Centralblatt für Gynäkologie*, 1887, Vol. xl.

<sup>23</sup> Bougarel, *France Médicale*, 1886, Vol. ii, p. 1232.

<sup>24</sup> The skin was protected with great difficulty. The discharge was so profuse that all protective powders—*e.g.*, stearate of zinc, starch, zinc oxide, bismuth, *et alii*, also ointments of all kinds, were soon washed off. Applications of collodion, and similar preparations, simply kept the fluid in contact with the skin, for it at once undermined the layer, and wherever it touched the epidermis was soon digested off, leaving a very sensitive surface. This was a source of greater discomfort than the operation. Attempts to chemically neutralize the fluid with the common vegetable or mineral acids were futile. After much experimenting the patient was finally relieved by painting the abdomen with compound tincture of benzoin, and after this the skin healed rapidly, and there was no more trouble as long as it was thus protected.

ENTERORRHAPHY WITHOUT BUTTONS,  
PLATES, OR RINGS.

By JOHN I. SKELLY, M.D.,

PEKIN, ILL.

THE adoption by many surgeons of some of the various devices which have been placed before the profession in recent years for the purpose of saving time in the operation of enterorrhaphy seems to me to be an error, and I am inclined to think the object sought—speed—is not attained. It is useless to mention the various inventions to which American genius has given birth. They are legion. The most popular, and, in my humble opinion, the most dangerous is Murphy's button. Its chief commendation is that it shortens the time of operation. And then it is claimed by many writers that "almost any doctor can use it." May not this latter proposition be an objection rather than a recommendation? It occurs to me that one who is incompetent to do an enterorrhaphy scientifically should not undertake it with or without a button. Right here I desire to say that many claims are urged in favor of Murphy's button that did not originate with the inventor.

The adoption of any of the various devices is an admission upon the part of the operator that he can do nothing better. This is a proposition I cannot accede to. Of course, we all aim to complete the operation as speedily as possible, and the desire to accomplish this is what has led to the use of the various contrivances now in vogue. The preliminary steps in the operation are identical, whether a button is used or not. It is when we have reached the intestine that the divergence of opinion occurs as to the most speedy way of uniting the divided intestine. It is claimed that Murphy's

button can be put in position and union accomplished in much less time than by any method of suture. It may be that the enthusiastic advocates of the button can gain time by its use. I cannot. But I can and do make a perfect union in less time than I have ever known of any operator doing with a button or any other invention. I devised the operation more than ten years ago, but have not published it further than by some remarks in a discussion on enterorrhaphy in the Peoria Medical Society several years ago.

Several other surgeons have perfected operations very similar to my own, notably Drs. Davis and M. L. Harris, of Chicago. Dr. Harris resected fifty-one centimetres of

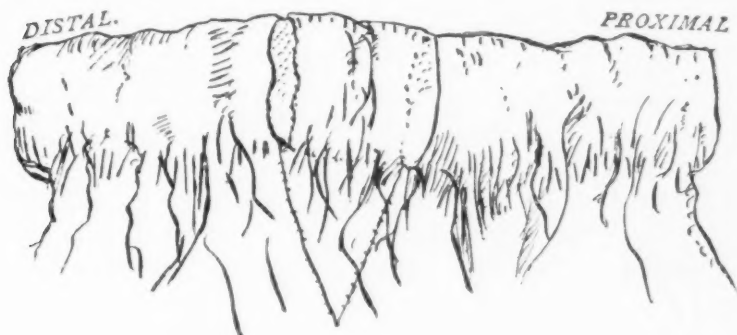


FIG. 1.

small intestine, and completed the operation in fifteen minutes (*Chicago Medical Record*, January, 1897).

*Operation.*—Fig. 1 shows intestine and mesentery with supposed line of excision. A cuff one-half inch wide is turned back on the distal end and the mucous membrane is thoroughly removed. (Fig. 2, *A*.) From the proximal end the serous coat is removed for one-half inch. (Fig. 2, *B*.) This operation is greatly facilitated by introducing some solid substance into the end of the intestine—a glass vaginal speculum or anal dilator.

The mucous and serous coats removed, a fine catgut suture with a straight needle on each end is passed through the muscular coat of the proximal end. The needles are in-

troduced about one-quarter inch apart, and near the cut end of the gut. They are then passed through the exposed muscular tissue of distal end near the line of denudation, and brought out beyond the edge of cuff without penetrating the

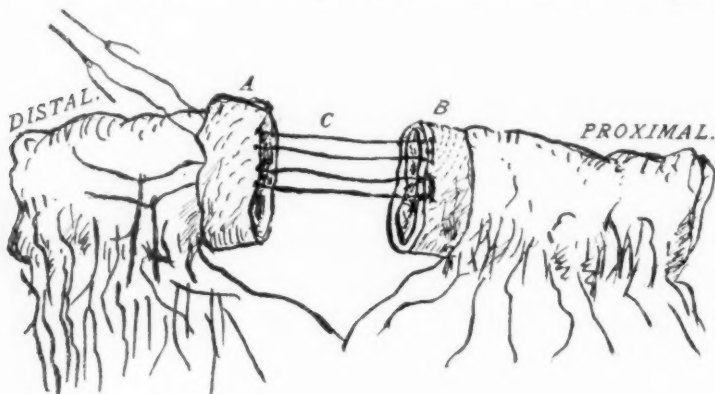


FIG. 2.

serous coat. These sutures are continued clear around the gut. (Fig. 2, C.) When these sutures have all been placed the distal cuff is turned back over the denuded proximal end, and

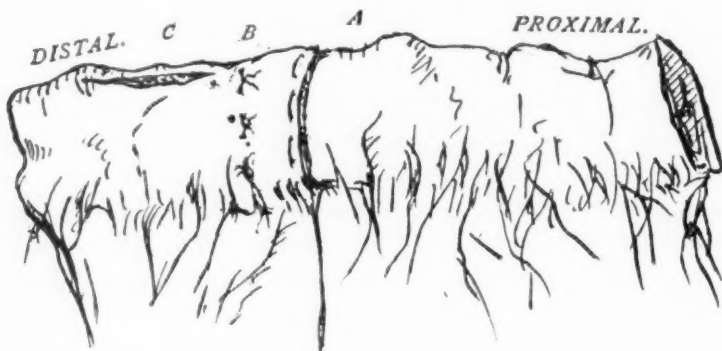


FIG. 3.

the sutures are tied. (Fig. 3, B.) The serous coats of the proximal and distal ends are then united by either interrupted or continuous sutures. (Fig. 3, A.) Some extra sutures may be necessary at mesenteric attachment. If there is any doubt

as to the proper coaptation of the mucous membrane, an opening may be made in the gut opposite the mesenteric attachment (Fig. 3, C), which will permit ocular inspection and the introduction of a finger for exploration. This has not been practised since the first early experiments. This operation is easily and speedily completed, and there is no foreign substance left in the bowel to annoy either patient or surgeon. Union is perfect, and there is no contraction.

A MEANS OF REGULATING INFLATION OF THE  
BLADDER PRELIMINARY TO SUPRA-  
PUBIC CYSTOTOMY.<sup>1</sup>

By WILLIAM JEPSON, M.D., L.R.C.S. (Ed.).

OF SIOUX CITY, IOWA,

PROFESSOR OF SURGERY AND CLINICAL SURGERY, SIOUX CITY COLLEGE OF  
MEDICINE; SURGEON TO ST. JOSEPH'S MERCY HOSPITAL.

In presenting this paper it is not my desire to consider the relative merits of the various routes open for selection when necessity demands our entering the bladder for relief of the various pathological conditions to which this viscus is subject, as each will have its exponent under certain circumstances. Suffice to say that the suprapubic route will unquestionably so frequently be one of election or necessity with the surgeon of to-day that a brief consideration of technique facilitating the operation with safety, I trust, may not be devoid of interest to such as feel at times the need of artificial aids. Prior to the investigation of Garson and Peterson epicystotomy was in disrepute with many of the best surgeons of the time, owing to the difficulty experienced in reaching the undistended bladder through the limited space presented by the *cavum Retzii* without wounding the peritoneum. Probably also to imperfect comprehension of aseptic technique, with its serious consequence. Since Peterson, in 1880, introduced the rectal bag, with the object of projecting the bladder, already filled with water, against the anterior abdominal parietes, increasing this space, and thus facilitating the operation, its area of usefulness has become

<sup>1</sup> Read before the Western Surgical and Gynæcological Association, Denver, Col., December 28, 1897.



much extended, making it a favorite with many surgeons at present who carry out the technique advocated by Peterson in its entirety, or slightly modified, or who avail themselves of other adjuncts.

Of recent years some of our ablest surgeons, notably W. W. Keen, A. T. Bristow, and F. Tilden Brown, have been led to consider the relative merits of air and water as a medium for distending the bladder, and, in my opinion, with most flattering results in favor of the air.

Dr. Algernon T. Bristow, in a most able article (*ANNALS OF SURGERY*, June, 1893), entitled "The Use of Air to Distend the Bladder in Suprapubic Cystotomy," most vividly points out the advantages of air over water as an aid to this operation, and from which I beg permission to quote the following:

"While making some experiments upon the cadaver with regard to suprapubic cystotomy according to the usual method, I injected the bladder with water, having first stuffed the rectum with tow to take the place of the Trendelenburg rectal bag. After numerous trials, I found that after dilating the bladder with ten ounces of water not one-half inch of space could be expected to intervene between the symphysis and the peritoneal fold, no matter how great the distention of the rectum. Yet in the dissecting-room, in many more cases than I can remember, I had, by means of air, readily lifted this fold so that two or three inches of the bladder wall rose above the symphysis uncovered by the peritoneum and available for an incision, and this without anything in the rectum whatsoever."

The advantage of air over water, as set forth in the foregoing, in itself, I think, should be sufficient to lead to its constant employment when any form of distention is desired; but many other advantages, hardly second in importance to that already indicated, have been pointed out to the above authority, and upon whose writings I have largely depended in the preparation of the following *résumé*:

The first desideratum in distention of the bladder pre-

liminary to epicystotomy is increased accessibility of that viscus so as to minimize the liability of injury to the peritoneum. Air has been shown both experimentally and practically to afford this to a greater degree than water. First, because air, owing to its buoyancy, will render the bladder of lighter specific gravity than its surrounding media; hence it will rise out of the pelvic cavity and be approximated to the anterior abdominal wall to a degree commensurate with its normal attachments. While water, on account of its ponderability, must of necessity cause the bladder to gravitate to the most dependent part accessible, so that its anterior wall would only become approximated to the abdominal wall after its general distention had crowded it beyond the pelvis, or it is lifted forward by distention of the rectum.

The second desideratum (but certainly not second as to importance) has reference to the safety to procure employment, for, as it is well understood, the diseased bladder is very liable to present conditions which will make it liable to rupture upon being distended by whatsoever means employed. This certainly is a real danger, and one most likely to be encountered where distention is apparently most needed. This danger, I believe, may be considered as dependent upon one or more of the following factors:

(1) Diseased condition of the bladder with thinning of its walls, the amount which can only be guessed at.

(2) Through the distending forces we employ, being illy regulated and overcoming the resistance of the bladder, with resulting rupture, or through the distending medium being fixed in the bladder by occluding the urethra, as is generally done, so that struggles of the patient or contraction of the bladder subject the distending medium to increased pressure, with the result of rupture, and in the event of water being used the danger is largely increased through its non-elasticity.

(3) After rupture (if through that portion of the bladder covered by peritoneum) of the distending medium being expelled into the peritoneal cavity and probably exciting peri-

tonitis, through carrying with it septic material from the bladder.

As already stated, the first factor is not within our control; but I believe the other two are, and if this be true, it must certainly minimize the risk which our patients incur from this source. In placing the last two factors under our control I deem it of the highest importance that we employ an amount of force which shall not be in excess of the presumed resistance of the bladder, and that it be so regulated as not to permit the intravesical tension to rise above this, while such media for distention should be used as will further lessen the liability to rupture or minimize its dangers when occurring, and with this in view air again seems to be a much more suitable agent than water, because, as pointed out by Bristow, air being compressible while water is not there is less liability of rupture resulting. On the other hand, water by its own weight, eight to ten ounces, might possibly induce rupture through this fact, which could not result from the use of air. Further, if the bladder were ruptured into the peritoneal cavity and water was used for distention, it might possibly infect the same, which sterilized air would not be so likely to do, and this, it seems to me, is of importance.

To Keen belongs the credit of first advocating and using filtered air to determine as to the existence of a rupture of the bladder (*ANNALS OF SURGERY*, July, 1890), as well as having done the first suprapubic cystotomy, using air in the place of water, according to the suggestions of Bristow (*ANNALS OF SURGERY*, June, 1893).

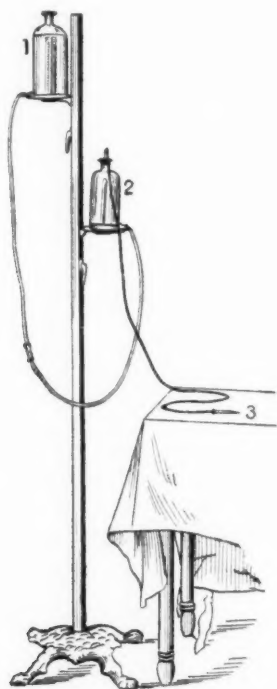
With such authoritative recognition of the merits of air as a medium for bladder distention, why is it that it has not found greater favor among surgeons? Permit me to quote from F. Tilden Brown's article on "Air Distention of the Bladder" (*ANNALS OF SURGERY*, February, 1897), which, I think, to a great degree gives the clew: "Despite such occasional authoritative statements regarding air distention of the bladder, it seems to receive very tardy recognition, and it is to be noted that the contributors of the articles on genito-

urinary subjects in the recent surgeries and hand-books of reference detail Petersen's method and barely allude to air, its simpler, safer, and more effective substitute. It may be that the want of some ready and reliable contrivance for throwing air into the bladder had been the main cause of its tardy acceptance. In attempting to throw air into the bladder with a Davidson syringe others may have had the same experience as my own,—namely, that the valve of the syringe, which worked perfectly with water, would at frequent intervals, in attempting to pump air, fail to respond to the pressure of this lighter medium, unless the valves were held in a way to be aided by gravity at the same time. I believe that the small double-acting bicycle pump will prove the most convenient for bladder inflation."

In considering the matter of devising means of readily and efficiently distending the bladder with air it appeared to me that any method employed must be possessed of the following essentials,—namely, that the force used for impelling the air into the bladder must be susceptible of regulation and determination as to the amount used, so that it should not be in excess of what the bladder might be presumed capable of withstanding, and as an aid to this, that the amount of air impelled into the bladder should be easy of determination. Further, that the air be not rigidly confined in the bladder, but susceptible of at least partial displacement when causes such as already referred to would increase the tension upon the medium and otherwise have a tendency to rupture the bladder. These conditions, I believe, may be in a large measure met by simple device which I will describe. I say simple, because any one can easily construct it for himself, except the stand, for which an ordinary irrigating stand can be substituted; all that is needed being two glass irrigating bottles, glass and rubber tubing, all of which can be procured by any village apothecary, and it can be manipulated quite as easily as a fountain syringe. It consists of a stand having two movable platforms, upon which rest the two bottles used, which are graduated by ounce-marks for easy determination

of their contents. Each have a spigot at the bottom, by which the two are connected by means of a properly fitting rubber tube about three feet in length, which has a clamp for closing the tube. One of the bottles is filled with water, the other bottle is fitted with rubber cork, air-tight, and fixed sufficiently rigid to withstand the required pressure. The cork has two perforations, into which are fitted two small glass tubes, to one of which is attached a rubber tube of sufficient length to connect with a gum catheter introduced into the bladder. The connection between this tube and the catheter I make with the glass portion of the medicine-dropper, which may be packed full of sterilized cotton, which will filter the air before it enters into the bladder, if this be deemed essential. (Keen used cotton over the end of the syringe and Brown a specially constructed filter.) The other fitting I connect with the pressure-gauge, in this instance the U-glass tube filled with mercury graduated to show pressure used per square inch, and which has been accurately determined. The advantage of using this gauge being that one will be guided more by the pressure used (the normal bladder, according to my observation, receiving about ten ounces of air under a pressure of from one-half to three-fourths of a pound of pressure per square inch), and if only five ounces were received under that pressure we would suspect hypertrophy of the bladder wall, with its possible attendant sacculation, and consequently know that we were treading upon dangerous grounds and desist in further distention. The use of this pressure-gauge is certainly not essential, but will when used largely lessen the danger of rupture. I will briefly describe its practical use. I first irrigate the bladder thoroughly with a Thiersch or other solution, as may be indicated, after which the bladder is emptied, the catheter (soft gum) is left in position, a rubber band being slipped around the penis to retain the catheter. The platform upon which rests the bottle (No. 1) containing the water is now elevated above the other about eighteen inches, the clamp upon the rubber tubing connecting the two bottles opened, and the water permitted

to enter the lower bottle (No. 2) until the point at which the graduating of the same begins. The connection between the two bottles is now closed, and the connection between the bottle (No. 2) containing the air and the bladder is now made by inserting the glass tip (No. 3) into the catheter. The clamp is again opened, and is not closed until the operation is over, for if this be done the air will be rigidly confined in



Jepson's device for inflating the bladder with air.

the bladder with increased danger of rupture. When the required amount of air has entered the bladder determined by the amount of air displaced (I have used about ten ounces) or pressure employed which is deemed safe (possibly not over three-fourths of a pound to the square inch), the platform containing the bottle No. 1 is permitted to descend till the force of the bladder and the column of water are equal, easily

observed by the fact that no more air is being displaced, the platform is fixed and the operation may be proceeded with. Let me state that whoever may try this method may observe, as I did in my first case, that the bladder, through its contraction or contraction of the abdominal muscles, may expel much of the air, which will, of course, find its way into the bottle, only to return as these forces cease to act. The outline of the bladder can easily be determined by the tympanitic percussion note when thus distended. I have used this method of distending the bladder in two suprapubic cystotomies for vesical calculi, the first of which was operated upon March, 1897, and the other recently. In both of these instances the results were all that I could have wished for, and the advantages which appeared to me to result from its use were:

(1) Those of air in general depending upon its physical characteristics, as has already been pointed out.

(2) The apparatus affords a simple, efficient, and certain method of forcing the air into the bladder.

(3) The force employed is under perfect control, easily regulated, and the amount used readily determined by the gauge.

(4) The amount of air which has been forced into the bladder is readily and accurately determined.

(5) The air is maintained in the bladder under equitable pressure, but not rigidly confined.

These last three I deem of much importance, as largely minimizing the dangers of rupturing the bladder.

## FOUR ATYPICAL CASES OF APPENDICITIS.<sup>1</sup>

By GEORGE EMERSON BREWER, M.D.,

OF NEW YORK,

ATTENDING SURGEON TO THE CITY HOSPITAL; ASSISTANT DEMONSTRATOR OF  
ANATOMY, COLLEGE OF PHYSICIANS AND SURGEONS.

ALL who are accustomed to deal surgically with appendicitis are aware that cases are frequently encountered which differ so markedly from the typical descriptions of the disease as to present many serious difficulties in diagnosis, as well as important questions regarding prognosis and treatment. It is the writer's opinion that all such atypical cases should be reported; that our knowledge may be increased regarding the behavior of this disease under unusual and varying conditions. Although the writer does not regard the cases herewith reported as unique, still they all presented features new to him at the time and sufficiently rare to justify a brief report.

*CASE I.—Inflamed Appendix concealed in a Subcæcal Fossa.*—A woman, aged forty-eight years, was transferred to the Surgical Department of the City Hospital, suffering from general abdominal pain, nausea, slight tympanites, and fever. She was first seen by the writer about twenty-four hours after the onset of the symptoms, at which time she presented a typical clinical picture of an acute appendicitis of rather a severe type. There was moderate tympanites, muscular rigidity of the right half of the abdomen, and marked tenderness in the vicinity of McBurney's point. Temperature, 102° F.; pulse, 120. As the case seemed to be uncomplicated, and as the patient gave no history of previous attacks, I asked my house surgeon to operate. The patient

<sup>1</sup> Read before the Harvard Medical Society, April 23, 1898.



was etherized, and after careful disinfection of the abdomen an incision of about four inches in length was made near the outer border of the right rectus muscle, and the peritoneal cavity opened. The ileo-cæcal region was easily exposed, but no sign of an appendix was found. The longitudinal muscular bands of the colon were next followed downward to a point of meeting at the lower border of the cæcum, but not the slightest evidence of anything resembling an appendix was discovered. The peritoneal coat of the large intestine was only slightly injected, was not covered with lymph, and apparently passed from the gut to the posterior and lateral walls of the abdomen in an unbroken outline, without any evidence of adhesion or scars of previous inflammation. A rather large appendix epiploica was seen occupying a position in the inferior ileo-cæcal fold of peritoneum, and after prolonged search it was thought that an abnormally small vermiform appendix might be found in the centre of this mass. It was therefore ligated and removed, but was found on section to be made up wholly of adipose tissue. The patient was then placed in the Trendelenburg position, the incision lengthened, and the cæcum drawn well upward into the wound. This resulted in a slight tear at the junction of the parietal and visceral portions of the peritoneum, opposite the lower border of the cæcum, through which protruded the very red and swollen tip of the buried appendix. The opening was enlarged, and the entire appendix and its mesentery were found in a large subcæcal fossa, which was lined with peritoneum, but which apparently had had no connection with the general peritoneal cavity. The appendix was removed, the cavity disinfected, and packed with gauze. The abdominal wound was united with sutures, dressings applied, and the patient placed in bed. She made an uninterrupted recovery, and has since been well.

The writer is aware that large subcæcal peritoneal fossæ are by no means infrequent, and that the entire appendix and its mesentery may often be found to occupy a position within this fossa. In nearly all of these cases, however, the base of the appendix may be easily found at the point of junction of the longitudinal muscular bands, and the appendix traced from this point into the fossa. It occasionally happens also that this fossa is shut off from the general peritoneal cavity

by inflammatory adhesions. From an examination, however, of a large number of abdomens during the past six years in the dissecting room of the College of Physicians and Surgeons, the writer has never seen a case exactly similar to the one reported, which might easily be regarded, from all external appearances, as a case of congenital absence of the appendix.

CASE II.—*Extraperitoneal Retrocæcal Appendix*.—A middle-aged woman was transferred to the Surgical Department of the City Hospital with the diagnosis of abscess of the groin. The patient had complained for several days of indefinite abdominal pain and tenderness, and was first admitted to the Gynæcological Ward, upon the supposition that she was suffering from some chronic pelvic trouble. She was carefully examined by a member of the house staff, who reported the result of his investigation as negative. For several days thereafter she was about the ward as a helper, and made no complaint to the physicians or nurses, which led to a further examination until about 4 A.M. of the morning of her admission to the Surgical Ward. At this time the house physician was called to relieve a severe pain in the right iliac region, which he found markedly indurated, hot, red, and tender. She was transferred to the Surgical Ward early in the morning and was seen by the writer shortly after noon. Her condition at that time may be stated as follows: Temperature,  $103^{\circ}$  F.; pulse, 130; respiration rapid and shallow, extremities cold, expression anxious. There was a deep-red, boggy induration of the abdominal wall, extending from the right groin nearly to the free border of the ribs and for several inches to the left of the median line. Near the middle of Poupart's ligament was a small ulcerated opening, which discharged a small amount of a very foul-smelling, dark-colored pus.

Under ether anæsthesia a curved cutaneous incision was made from the tip of the twelfth rib to the opening near the middle of Poupart's ligament. This opened up the subcutaneous cellular space, which was found to be filled with a grayish necrotic mass, consisting of areolar tissue and the aponeurosis of the external oblique muscle. A sinus occupying a position near the internal abdominal ring connected this space with a very large, deep-seated abscess cavity, which was freely laid open by cutting

with scissors the remaining muscular layers in the line of the original incision, and which extended from Poupart's ligament, behind the cæcum and ascending colon, to the right kidney. Upon raising up the tissues forming the roof of this enormous abscess cavity, a gangrenous vermiform appendix was seen on the under surface of the colon. During an attempt to secure and remove this, the anæsthetist announced that the patient was pulseless. A large mass of gauze was hastily stuffed into the wound and a binder applied. The patient was given hypodermic injections of strychnine and digitalis, and an enema of hot coffee; external heat was applied and stimulant measures continued for several hours. After a prolonged period of profound sepsis, the patient rallied, ultimately recovered, and was completely restored to health.

From the rapidity of this process, and from the very extensive cellulitis, both subcutaneous and retroperitoneal, I infer that we had to do with a streptococcus inflammation of an extraperitoneal, retrocæcal appendix; that this process extended in the cellular tissue, both upward to the kidney region and downward following the round ligament to the external abdominal ring, where it rapidly spread in the loose subcutaneous areolar tissue.

CASE III.—*Intermittent Colic; supposed Typhoid Fever; Median Abdominal Induration; Incision; Large Pus-Cavity; Fæcal Fistula from Ulcerated Appendix; Pneumonia; Full Recovery from Abdominal and Pulmonary Conditions; later Fatal Intestinal Obstruction from Strangulation by an Adhesion Band.*—A young woman, aged twenty-five years, married, on several occasions during the past few years had experienced attacks of nausea, vomiting, and abdominal pain, which were usually relieved by a cathartic and a few days of rest in bed.

In February, 1896, while on a pleasure trip in Florida, she experienced one of these supposed attacks of acute indigestion, which was so severe at its onset as to necessitate a hypodermic injection of morphine for its relief. The following day she seemed relieved, but had a moderate amount of fever. This continued, varying from 100° to 102° F. without pain or other symptoms. At first it was thought to be due to malarial poison-

ing, but as it resisted treatment by quinine, it was afterwards regarded as a mild typhoid. Ten days after the beginning of the attack, by the advice of her attending physician, she was brought to her home in New York. She was seen by the writer immediately after her arrival, and presented the following condition: Temperature,  $102^{\circ}$ ; pulse, 100; respiration normal; tongue thickly coated; abdomen slightly tympanitic but without tenderness to pressure, with the exception of a small area in the left iliac fossa. Vaginal examination negative; urine normal. Patient did not complain of pain or discomfort, but felt tired. Mind seemed slightly sluggish. No cutaneous eruption. I stated to the family that, although I was unable at that time to make a positive diagnosis, I regarded her condition as probably one of mild typhoid. The following day she seemed better. Morning temperature  $99.5^{\circ}$ , evening,  $100.5^{\circ}$ ; no other symptom. Patient took nourishment plentifully; bowels acted normally. During the next three days the temperature rose gradually; the tenderness in the left iliac region became slightly more marked, and there was a distinct induration detected by bimanual touch in the region of the left broad ligament. She was then seen in consultation by Dr. H. M. Painter, who agreed with me in the belief that a positive diagnosis was impossible, but considered the condition as due either to a left-sided salpingitis, the early rupture of an extrauterine pregnancy, or to a suppurating cyst of the ovary or broad ligament. He also felt that it was impossible positively to exclude typhoid fever. A delay of a few days was advised, with the understanding that, if the symptoms did not abate, an exploratory laparotomy was to be undertaken. From this time there was a gradual increase in the induration with an accelerated pulse, but without increased fever, muscular rigidity, or local tenderness. In fact, the patient complained of no pain and expressed herself as feeling more comfortable. Four or five days after the first consultation she was again seen by Dr. Painter. The abdominal mass had increased, and seemed to be about the size of a small cocoanut; it occupied a position in the median line, extending more to the left than the right. There was, however, for the first time more tenderness in the right inguinal region than over the centre of the mass. The uterus was pushed forward and was rigidly fixed; there was induration, but no tenderness, over the entire pelvic roof. The temperature kept

between  $101^{\circ}$  and  $102.5^{\circ}$ ; the pulse ranged in the neighborhood of 120 and was of fair quality. The patient complained of no discomfort, was cheerful and bright; took plenty of nourishment and slept well. It was the opinion of all who saw her that the case was probably one of a gradually increasing hæmatoma following the rupture of an extrauterine pregnancy, and an exploratory operation was decided upon.

Under ether anæsthesia an incision was made in the median line from the umbilicus to the pubic bone, and the peritoneal cavity opened. A tense, fluctuating mass was found occupying the entire lower third of the abdomen, which ruptured while being gently palpated, and flooded the entire abdominal cavity with foul, fæcal-smelling pus. Digital exploration of the abscess cavity revealed a lateral extension to the ileo-cæcal region, which was completely walled off by firm adhesions. A counter opening was made here, the entire abdominal cavity thoroughly irrigated with several gallons of sterilized salt solution, and an enormous Mikulicz drain of sterile gauze introduced. Although at the end of the operation the patient's condition was extremely critical, she passed a fairly comfortable night, and by morning had rallied, showing a temperature of  $100^{\circ}$  F.; pulse, 104. The dressing was changed on the second day under chloroform, when a small amount of fæcal matter was found in the wound. Following this dressing there was a gradual rise of temperature, but no vomiting, pain, tympanites, or other symptoms of general peritonitis; the bowels moved freely, and the patient took plentifully of nourishment. At the second dressing a larger amount of fæcal matter was found in the wound. At this time two large rubber drainage-tubes were inserted, and afterwards the wounds were irrigated and dressed twice daily. The cavity diminished rapidly in size, the wound granulated nicely. There was no pain or tenderness either to abdominal palpation or vaginal touch, but the temperature and pulse kept up,—the former ranging between  $101^{\circ}$  and  $102^{\circ}$ , the latter between 120 and 140.

At this time the patient was seen in consultation by Dr. F. H. Markoe, who agreed with Dr. Painter and the writer that there was no indication at present for further exploration, but that if the temperature and pulse did not improve within a reasonable time, an exploration of the wounds under ether would be advisable. A week later this was done, and a pocket of pus found

deep in the pelvis behind the uterus, and was drained through Douglas's pouch by a large tube which was passed from the median abdominal wound through the posterior cul-de-sac into the vagina. No appreciable improvement followed, and although the patient's general appearance seemed satisfactory, the pulse and temperature remained practically the same for a period of ten days or two weeks. Then, although the abscess cavity seemed healed closely around the drainage-tubes, and the fecal fistula had nearly closed, there occurred a gradual rise in temperature and pulse, with an indefinite tenderness over the ascending colon and well into the hypochondriac region, but no induration or other evidence of an inflammatory process. A consultation was then held at which Dr. E. G. Janeway and Dr. Markoe were present, and after a most careful examination no additional facts were determined which would point to the cause of the trouble. It was thought, however, by all that the possibility of an ascending retroperitoneal cellulitis, with the formation of a subphrenic abscess, should be considered. Exploratory puncture was, however, postponed until the following day. About eight o'clock that evening the temperature rose to  $105^{\circ}$ , pulse to 180, respiration to 50 or 60 to the minute. Between 10 P.M. and 4 A.M. it was impossible to count the pulse; the patient was unconscious and appeared to be dying. She was given large doses of strychnine, atropine, and digitalis hypodermically, and large enemata of whiskey and water. The next day she rallied somewhat, and when her condition warranted an examination, she was found to have the signs of a well-marked pneumonia extending over the middle and lower lobes of the right lung. During the week which followed, at no time was her pulse below 140 or the temperature below  $103^{\circ}$ . At the end of this time she began to improve, only to be again completely prostrated by the involvement of the lower lobe of the left lung. Her condition now seemed to all who saw her absolutely hopeless. Her temperature remained very high, her pulse rapid and feeble, and her respirations hurried and shallow. The abdominal condition, however, was no longer a feature, and as her stomach still retained food and stimulants, these were pushed to the utmost limit of tolerance. For two or three weeks the condition remained unchanged, and then a gradual improvement began. The left lung cleared, but there was no resolution of the right, which continued to exhibit charac-

teristic evidence of consolidation for six weeks or more. On June 20, about fifteen weeks after her first operation, she began to sit up. Ten days later, after the removal of all tubes and the practical healing of all wounds, she had gained so rapidly that she was sent to the Adirondacks, where she continued to gain until she seemed completely restored to health.

Shortly after the receipt of a letter by the writer, telling of her marvellous gain and general satisfactory condition, came a telegram announcing a sudden attack of intestinal obstruction. Death quickly followed a laparotomy, which revealed a small knuckle of gangrenous gut which had been strangulated by an adhesion.

For some time the writer was at a loss to understand just what pathological condition could account for the peculiar and certainly unusual character of symptoms presented by this case. In examining one of the subjects in the dissecting room, shortly afterwards, an appendix measuring nearly eleven inches in length was found lying transversely across the anterior surface of the right broad ligament of the uterus, and extending well on to the left broad ligament, the uterus being markedly retroverted. Had this appendix lain behind the uterus, and had a small perforation occurred near its tip, which was followed by an ascending necrosis of the entire organ with the formation of dense adhesions, an abscess might have occurred, which would have presented symptoms and signs very similar to the case just recited.

My last case is perhaps the most unusual as well as the most difficult to explain.

CASE IV.—*Interstitial Appendicitis; Excision; Perirenal Abscess.*—The patient, a man fifty-six years of age, without previous attacks, was seized in the early part of October last with acute abdominal pain, nausea, and fever. The pain, at first general, soon became localized in the right iliac fossa, and increased in severity. The presence also of a marked leucocytosis led those in attendance to advise an early operation, which was done the following day. An appendix showing the evidences of an acute inflammatory process was removed, and the abdominal wound closed without drainage. The operation was unusually pro-



longed owing to the presence of an cesophageal diverticulum, which seriously interfered with the administration of the anæsthetic. For a day or two following the operation there was vomiting, fever, and a moderate amount of meteorism. These symptoms, however, quickly disappeared after a free evacuation of the bowels, and the patient made a satisfactory recovery, being up and about on the 21st day. For ten days or more after being up he gained rapidly, had an excellent appetite, and was able to go about without discomfort. About five weeks after his operation, while on his way to his winter home in the South, he experienced a dull pain in the right side, with loss of appetite and general malaise. This became quite acute before the end of his journey and necessitated his going to bed immediately after his arrival at his destination. A few days' rest, however, resulted in a marked amelioration in the symptoms, and he again began to walk about cautiously. The pain immediately returned, was accompanied by slight abdominal distention and fever. There was also a complete loss of appetite and a feeling of physical prostration. From this time on he was never free from pain, which would almost disappear if he remained quietly in bed, but would become acute whenever he walked about, drove or sat up for any length of time. The temperature was always above  $100^{\circ}$  F. at night, and after even moderate exercise would occasionally reach  $101^{\circ}$  or  $102^{\circ}$ . The morning temperature varied; at times it was subnormal, often normal, and occasionally between  $99^{\circ}$  and  $100^{\circ}$ . He took a large amount of nourishment but without relish; his weight remained about stationary. He became nervous, apprehensive, and despondent. This condition of affairs continued for about five weeks, until a chill, followed by a temporary increase in the temperature, led to a consultation with the writer. His condition at this time may be briefly stated as follows: Temperature,  $100\frac{1}{4}^{\circ}$ ; pulse, 104; complains of only moderate pain in the right side of abdomen, which is increased on extending the right leg or by lying on the left side. Heart and lungs normal. Abdomen flat and soft to gentle palpation. Scar of original operation firmly united, iliac region free from tenderness or induration. Upon deep palpation in the right hypochondriac and lumbar regions, a fair amount of muscular resistance was encountered, which was not observed on the corresponding area on the left side. An indurated mass was also noted here, about the size



of the closed fist, deeply seated, and more easily palpated at its lower margin, which was about the level of the iliac crest. Slight fulness and sense of resistance in the interval between the last rib and iliac crest behind. Liver and spleen not enlarged. Prostate and seminal vesicles normal. Urine free from albumen, sugar, or bile; contained a few leucocytes (the result of an old, deep, urethral and bladder trouble).

A specimen of his blood was obtained and sent to Dr. James Ewing, of the Pathological Laboratory of the College of Physicians and Surgeons, for examination, who reported well-marked leucocytosis. One week later the patient was again seen by the writer, this time in consultation with his family physician, Dr. Edward W. Cushing, of Cleveland, and Dr. John C. Munro, of Boston. As the patient had been in bed for five days, he complained of no pain and but little tenderness. The mass of induration felt through the anterior abdominal wall, although still present, had diminished somewhat in size, but there was a greater degree of fulness and œdema in the flank. Slight muscular rigidity, but well-marked tenderness over the right hypochondriac and lumbar regions. During the past five days the temperature had remained between  $100^{\circ}$  and  $101^{\circ}$  F.; pulse from 90 to 110. There was a distinct yellow tint to the skin over the entire body, but no discoloration of the sclerotics. Urine free from bile. It was agreed by all that the patient was suffering from septic absorption; that the focus was undoubtedly located in the right side of the abdomen, but whether within or behind the peritoneal cavity could only be determined by an exploratory operation.

The following day, under chloroform anæsthesia, an incision two inches in length was made in the right semilunar line, near the upper part of its middle third. The peritoneal cavity was opened, and the omentum found adherent to the cæcum, ascending colon, and lateral wall of the abdomen. After these adhesions were separated and the colon (which was freely movable, owing to the presence of a short mesocolon) pushed well towards the median line, a very hard indurated mass was felt about the thickness of two fingers, running upward on the posterior wall of the abdomen about one and a half inches from the spine, extending from the lower margin of the cæcum to the kidney. It was covered by peritoneum and apparently lay between it and the psoas

and quadratus lumborum muscles. A director was passed into the centre of the mass at three points without discovering any abscess cavity or area of softening. The wound was then temporarily packed, and the patient turned upon the left side. A second incision about five inches in length was made from the middle of the last rib obliquely to the crest of the ilium. After separating the fibres of the latissimus dorsi from the external oblique and piercing the posterior lumbar aponeurosis, the retro-peritoneal space was opened and freely explored. The indurated mass was felt and traced to a point under the right kidney, where a cavity was found, containing about one ounce of thin watery pus. The walls of the cavity were soft and velvety, and covered with a white, curdy material resembling a tuberculous pus. The cavity was curetted and packed with sterile gauze and the wound partly united.

The abdominal wound was nearly closed with four silkworm-gut sutures, but a small gauze drain was left which covered the areas punctured by the director. No reaction of any kind followed the operation. For the first time in two months the patient's evening temperature was below 100° F. The bowels were moved on the following day, and the patient took freely of nourishment.

The abdominal gauze drain was removed on the second day and replaced by a very small wick of iodoform gauze, which was removed two days later, and the anterior wound, which was perfectly dry and clean, allowed to close completely. The posterior wound was dressed every second or third day for several weeks, there being a moderate discharge of pus from the first. For two days after the operation the temperature remained at or below 100° F. A sharp rise occurred immediately after the first dressing, which began to decline in a few hours, kept between 100° and 101° for two or three days, then fell to normal, where it has since remained.

As it was thought that the indurated mass felt through the abdominal incision was unquestionably an infected inflammatory exudate, which might under favoring conditions break down into an abscess, the patient was instructed to remain in bed for at least five or six weeks, and then to get about very gradually, and only when walking produced no pain or tenderness.

On two or three occasions since the operation the patient

has had attacks of right-sided abdominal pain with slight abdominal distention, but without fever; as these were always accompanied by the passage of undigested food by the bowels, and were relieved by rest and free catharsis, they were regarded as of digestive origin.

It is now about thirteen weeks since the operation. The patient has gained nineteen pounds in weight, and is apparently well.

As the appearances of the pus at the time of operation strongly suggested a tuberculous process, cultures were made from material from the walls of the abscess cavity, which gave a pure growth of the *staphylococcus pyogenes albus*.

In the writer's opinion, but one explanation seems reasonable to account for the unusual train of symptoms presented by this case, and that is, that at the time of the original operation there was already an infection of the retrocaecal lymphatics, and that, even after the removal of the original focus with the appendix, the patient's resistance was not able to successfully overcome this lymphatic infection, which gradually extended along the lymphatic channels, producing a subacute retroperitoneal cellulitis, resulting in a collection of pus behind the kidney.

REPORT OF A CASE OF CASTRATION FOR EN-  
LARGED PROSTATE, WITHOUT BENEFIT,  
FOLLOWED ONE YEAR LATER  
BY PROSTATECTOMY.<sup>1</sup>

By C. M. NICHOLSON, M.D.,

OF ST. LOUIS, MO.,

PROFESSOR OF ANATOMY AND GENITO-URINARY SURGERY, BEAUMONT HOSPITAL  
MEDICAL COLLEGE.

IN February, 1896, J. S. B., sixty-four years of age, presented himself, complaining of passing urine ten or twelve times at night and six or seven times during the day, and of continual straining and tenesmus. He had had some trouble for several years, but during the previous four days only had the aggravated condition existed as described. Macroscopic examination of a bottle of urine, which he had brought, showed the presence of a very large amount of sediment. Rectal examination disclosed a bilateral enlargement of the prostate gland.

A prostatic catheter was passed and twelve ounces of residual urine drawn, which, upon microscopic examination, was seen to contain an excess of phosphates and some pus-corpuscles. He was advised to go to bed, a milk diet, an alkaline diuretic, and morphine suppositories were prescribed. Catheterism was resorted to twice daily, and after two weeks acute symptoms had subsided. Castration was declined. The following month he returned, his general condition being about the same except that more difficulty existed in passing the catheter. In April he consented to double castration, which was done on the 17th. On the 12th of May he was discharged from the hospital. I saw him at intervals of a week or two for three months, at the expiration of which time no improvement was noticeable. He afterwards disappeared.

In May, 1897, he again presented himself. The prostate

<sup>1</sup> Read before the Annual Meeting of the Missouri State Medical Association, April 25, 1898.

gland could then be seen forcing forward the anterior abdominal wall in the hypogastric region, when the patient was in a recumbent position. Only a few drops of urine had escaped at a time during the preceding week, and catheterization seemed impossible. I suggested removal of prostate gland, to which he readily consented.

A suprapubic incision was made, and on opening the bladder there projected into the wound a mass which I succeeded in enucleating just as a fibroid may be hulled out. After removing the projecting portion of the gland, weighing a little over seven ounces, I noticed a collar-like mass which occluded the urethra. This being cut I passed a grooved staff through the urethra, made a perineal opening into the bladder, inserting a drainage-tube. After washing out the bladder with a 1-per-cent. solution of nitrate of silver, I found I had to deal with an unusual amount of oozing, which I attempted to control with hot water, but without success. I then tried packing, using several yards of sterilized gauze in strips two inches wide, folded, and held in position by silk thread passing through the gauze, and tied to a large button just outside the perineal wound, one end of the strip extending out by the side of the drainage-tube. The suprapubic wound was closed and the patient put to bed.

Considering the patient's age and general condition he stood the operation wonderfully well. After being put to bed hot bottles were placed about him, and he was given one-twentieth grain of strychnine hypodermically, but a few moments later his pulse became so rapid and feeble that it could not be counted at the wrist. Two minims of nitro-glycerine, 1-per-cent. solution, were dropped upon his tongue, after which he rallied slowly. During the first week his temperature ranged between  $97.5^{\circ}$  and  $100^{\circ}$  F., and at no time during his illness did it exceed  $101.5^{\circ}$ . His bladder was irrigated daily with a solution of nitrate of silver, and by July the cystitis had almost disappeared, and his general health was vastly improved. At present he suffers no inconvenience except lack of control of his urine, necessitating the wearing of a urinal. While there is not the constant dribbling so usual in these cases, the moment he realizes a desire to urinate he is unable to prevent its immediate passage. However, his general condition is now fairly good, at least better than for some years, and he is in daily pursuit of his calling.

## TRANSACTIONS OF THE NEW YORK SURGICAL SOCIETY.

*Stated Meeting, April 27, 1898.*

The President, ANDREW J. McCOSH, M.D., in the Chair.

### RESECTION OF CLAVICLE FOR SARCOMA.

DR. B. FARQUHAR CURTIS presented a man, thirty-seven years old; a Swede by birth and a hatter by occupation. Nine years ago he had sustained an injury to the left shoulder, the exact nature of which was not made out: it is doubtful whether it was a simple contusion of the shoulder or a fracture of the clavicle. At any rate, he was unable to use the arm for some time.

When the patient came under the speaker's observation there was a tumor of the left clavicle, which consisted of a fusiform enlargement of the bone to about three times its ordinary diameter. The surface of the tumor was uneven, and the case was first regarded as one of simple hypertrophy of the callus, resulting from the old injury. The growth was cut down upon and a considerable quantity of what appeared to be normal bone was chiselled away. It was afterwards subjected to microscopic examination, and a report was received that it was normal bone.

The operation relieved the pressure on the nerves, and for a time the patient was entirely free from pain. Then the growth rapidly recurred, becoming larger than it was before, and clearly demonstrating that the case was one of osteosarcoma. A complete resection of the clavicle was accordingly done on March 10, 1897, and the microscopic examination confirmed the diagnosis. Since then there have been no signs of a recurrence at the site of the operation, but recently the patient has complained of a pain near the left nipple, and two weeks ago, he states, he felt something snap in that side of his chest. No thickening can be felt there, but clear bony crepitus can be elicited at the point of tenderness in the fifth rib, and the probability is that we have to deal with a secondary malignant deposit, with spontaneous fracture of the rib.

The functional result following removal of the clavicle was excellent; there is very slight drooping of that shoulder, and none of the rolling inward which one would expect.

[NOTE.—Subsequent operation confirmed the diagnosis of osteosarcoma of the rib.]

### MALGAIGNE'S OPERATION FOR EPITHELIOMA OF THE LIP.

DR. ALEXANDER B. JOHNSON presented a man, of forty-five years, who, when he came under Dr. Johnson's observation, about two weeks previously, had an ulcerating lesion involving the entire lower lip, with the exception of about one-third of an inch on either side, being a recurrence from an epithelioma, which had been removed some three months before. One of the glands in the submaxillary region was enlarged to about the size of an English walnut. Ten days ago the case was operated on by Malgaigne's method, which consists in raising two thick lateral flaps from the jaw and thoroughly removing the submaxillary contents; the two flaps are then brought together in the middle line, the mucous membrane from the inside of the mouth being employed for the purpose of making a new vermillion border for the lower lip. The operation is thorough, and usually produces a very good cosmetic effect.

The first operation done in this case, which was followed by such a prompt recurrence, shows the futility of incomplete operations in such cases.

In order to illustrate how little deformity ultimately results from the Malgaigne operation, Dr. Johnson showed a second patient where he had resorted to this method, about two years ago, for an epithelioma of the lower lip, with involvement of the submaxillary glands. The cosmetic effect in this case was excellent, scarcely any deformity being noticeable.

Dr. Johnson said that, during the past six years, thirty-nine cases of epithelioma of the lip had been operated on at the Roosevelt Hospital. The average age of these patients was fifty years, the oldest being seventy-six and the youngest thirty-two years. Twenty-one were Irish; fourteen American, and four German. The mortality of the operation in these thirty-nine cases was two, one dying of pneumonia and one of uræmia. Recently twenty-two of these cases had been communicated with, and it was learned that in five of them the disease had recurred. In two

of the cases the site of the recurrence was in the glands in the neck; in two it recurred in the scar on the lip, and in one in the liver. In one case, where the glands in the neck had become involved six months after the primary operation, they were removed, and the man has now been entirely well for three years. Of the twenty-two cases heard from the average time that has elapsed since the operation is two and one-half years: the longest time that has elapsed is five years, the shortest one year. Five of the patients have been free from a recurrence for five years; nine for three years. In almost all of the cases which were operated on recently, a more extensive operation was resorted to than was done five or six years ago. The speaker said that, personally, he believed in thoroughly cleaning out the submaxillary triangle in every one of these cases, whether the glands can be felt or not.

DR. JOSEPH D. BRYANT said he had operated on four cases of extensive epithelioma of the lip by this method, the first some twelve years ago. In three of them it was necessary to remove the entire lower lip, and in each of these a very good result was obtained. In one out of the four cases the disease recurred about eighteen months after the operation; in the other cases there was no recurrence while the patients were under observation,—a period of over two years. The last case he had had was one of especial interest: the patient was a man eighty-seven years old, with an epithelioma which involved two-thirds of the lower lip and a portion of the right cheek; there was marked infiltration of the glands on that side. The patient, in spite of his age, made a very good recovery. Dr. Bryant said he was strongly in favor of the Malgaigne operation in these cases.

DR. ARTHUR L. FISK said he had resorted to the Malgaigne operation in two cases. In the second case he had carried the incision well down on the neck, in order to get a better view of the submaxillary triangle. The speaker thought it advisable to remove the lymphatics in these cases as thoroughly as possible, because a recurrence is very apt to occur, either in the submaxillary or the cervical glands.

DR. C. L. GIBSON inquired whether the family history of cancer was well marked in the cases collected by Dr. Johnson. In no class of cases that had come under his observation was a definite family history of cancer so regularly elicited as in these lip cases.

DR. JOHNSON replied that most of the cases he had collected



were hospital cases, and no mention was made in the history whether there were any other cases of cancer in the family.

#### THE EXCLUSION OF PORTIONS OF THE INTESTINAL TRACT IN DISEASE.

DR. CHARLES T. PARKER read a paper with the above title.

DR. FRED. KAMMERER said that in three cases of fæcal fistula, where he had resorted to partial exclusion of the intestine by implantation, the results were very encouraging. In one of those cases the fistula was permanently closed by a small operation after six inches of small intestine, the entire ascending colon and one-half the transverse colon had been only partially excluded. In another patient from six to seven feet of the intestine were partially excluded by implantation; the patient made a good recovery, and has gained about sixty pounds in weight since the operation, although the fistula is still open, but scarcely discharges.

DR. JOSEPH D. BRYANT said that in one case of fæcal fistula, resulting from sloughing of the intestine in strangulated hernia, he had found it no easy matter to side-track the fæcal contents. After opening the abdomen, with the idea of doing a lateral anastomosis, he found that the site of the original hernia was surrounded by tissues which were matted together and much inflamed, and it was difficult to determine what parts of the intestinal tract were involved in the fistula and therefore suitable for anastomosis. He finally succeeded, however, in effecting the anastomosis.

Dr. Bryant said that some years ago, while performing one of these operations, he resorted to an expedient which assisted him materially in determining which portion of the gut he had in hand; this was to inject into the rectum a colored fluid, which could be distinctly seen coursing through the transverse and descending colon. Such an injection might also be made into the fistulous opening, or a flexible tube could be inserted and its course carefully followed.

#### PARTIAL EXCISION OF THE LOWER JAW FOR SARCOMA.

DR. WILLIAM B. COLEY showed the specimen recently removed in a case of partial excision of the lower jaw for sarcoma.

The patient was a man seventy-two years old. The disease had existed about six months. The patient made a good recovery, though there was considerable discharge from the cut ends of



Partial excision of the lower jaw for sarcoma. (Coley.)

the bone for some weeks. The operation was made exceedingly easy by the use of the Gigli wire saws. The accompanying drawing shows very well the size and character of the tumor.

#### TUBERCULOSIS OF TENDONS.

DR. B. FARQUHAR CURTIS presented a specimen removed from a boy, ten years old, who was admitted to St. Luke's Hospital because of tubercular disease involving the tendon sheaths of the palm of one hand. The tendon sheaths were exposed and the diseased tissue cut away. It was then discovered that two of the superficial flexor tendons of the hand disappeared in the granulation-tissue, having been entirely destroyed by the tuberculous process. The manner of their destruction was worth noting, for the infection appeared to have spread along the central fibres, leaving the superficial layers expanded like a capsule over the tuberculous deposit in the centre of each tendon. While tuberculous tenosynovitis is a sufficiently common affection, the authorities state that the tendons themselves always resist the infection, and the speaker had never seen them attacked in any other case. The functional result of the operation was excellent.

DR. C. L. GIBSON thought that the involvement of the tendons in this case was, perhaps, attributable to an unusual degree of vascularity of the tendons, their meagre blood-supply usually protecting them from a hæmic tubercular infection.

## TRANSACTIONS OF THE PHILADELPHIA ACADEMY OF SURGERY.

*Stated Meeting, May 2, 1898.*

The President, J. EWING MEARS, M.D., in the Chair

### INTRAPERITONEAL RUPTURE OF THE BLADDER.

DR. JOHN ASHHURST, Jr., reported the case of a man who had been injured by a fall while drunk, and who had a small wound on the right side of the scalp, to close which two sutures had been introduced. There was a small area of abdominal ecchymosis, and the abdomen was distended, tympanitic, rigid, and tender, the swelling extending almost from the pubes to the chest.

There was dulness laterally in both flanks, with acute pain throughout the abdomen. No urine had been passed since the accident, and the bowels had not been moved. The resident physician had introduced a catheter and had drawn off about three fluidrachms of a dark-red fluid, which contained much blood. The diagnosis of rupture of the bladder was made, and was confirmed by the introduction of sterilized water to the amount of four fluidounces, only a few drops returning through the catheter.

The patient was then etherized and placed in the Trendelenburg position, the rectum being distended by means of an inflated india-rubber bag. The abdomen was opened by a median incision, a large quantity of fluid being found in the peritoneal cavity. When the fluid escaped, a large irregular opening was seen in the fundus of the bladder, extending also into its anterior wall, the rupture thus being both intraperitoneal and extraperitoneal. The vesical wound was carefully closed, interrupted Lembert sutures of silk being used for the intraperitoneal part, while a continuous suture was employed for the remainder. The abdominal cavity was then washed out with normal salt solu-

tion, and the external wound closed, a glass drainage-tube having been introduced and lightly packed around with iodoform gauze.

A soft rubber catheter was introduced into the bladder and retained in order to prevent urinary accumulation. The pulse became rapid during the operation, and shortly afterwards the temperature was recorded as 98° F., the pulse 120, and the respirations 42. The highest temperature was recorded three days later, just before death, when it rose to 105°. The tube in the abdominal cavity was cleansed every half hour. The patient was given strychnine and digitalis hypodermically and carbonate of ammonium by the mouth. The fluid removed through the tube at each cleansing amounted to about two teaspoonfuls, and urine was passed freely through the catheter.

The next day the patient had some cough, with pain in the abdomen, and he complained of thirst. On the second day milk was given in small quantities. The patient passed a good deal of flatus, and for the first forty-eight hours the abdomen remained quite scaphoid, but subsequently began to swell. The night before death he vomited some green fluid. An evacuation of the bowels was secured by an enema of magnesium sulphate, but the abdominal distention continued; the patient became delirious, and death followed at the end of three days.

Dr. Ashhurst referred to the rarity of uncomplicated rupture of the bladder, and said that there were probably not more than 150 cases on record; rupture of the urethra was much more frequent. Rupture of the bladder is almost always due to external violence, the viscus being distended at the time, and sometimes may be caused by counter-stroke, as by a fall on the buttocks. Bartels's statistics of intraperitoneal rupture of the bladder treated without operation showed but four recoveries out of ninety-eight cases, though when the rupture was extraperitoneal the mortality was not so high, twelve patients recovering out of fifty-four.

The modern treatment by abdominal section and suture affords better results, thirty-three intraperitoneal cases thus dealt with having given thirteen recoveries, a mortality of only 61 per cent. as contrasted with 96 per cent. under the old methods; and it is interesting to remember that the first suggestion of the modern practice was due to the late Dr. S. D. Gross, the founder of this academy.

When the rupture is extraperitoneal, the treatment may consist in drainage by a catheter alone, if this can be passed immediately; or, if extravasation has occurred, by prompt cystotomy, either by a perineal opening or above the pubis.

As to the diagnosis of intraperitoneal rupture, the symptoms will suggest the nature of the case, the patient being unable to pass any water, and evidences of peritonitis being quickly developed. But the surest test is that suggested by Dr. Weir, the injection of a definite quantity of fluid, and the attempt to withdraw the same through a catheter. When no fluid is returned, the inference is that the rupture is intraperitoneal, and that laparotomy is necessary. The Trendelenburg position is of great advantage in this operation, in facilitating the exposure of the vesical lesion, and distention of the rectum is also important. When the seat of rupture is brought into view the opening should be closely sutured, as in other wounds of hollow viscera.

DR. OSCAR H. ALLIS said there was one way in which the bladder might be injured besides those mentioned by Dr. Ashurst,—viz., the separation of one portion of the pelvis from the other. The attachments of the crura penis are such that the urethra and bladder may be torn by a separation of the sides of the pelvis.

DR. G. G. DAVIS inquired as to what means might be taken to avoid the occurrence of such peritonitis as had developed in the case reported. In all intraperitoneal operations, involving the hollow viscera, the danger of peritonitis from leakage, in spite of the most careful suturing, is very great, and the question is what can we do to guard against it. He believed a most efficient method was to isolate the seat of operation by packing, using a sufficient amount of gauze to push the intestines some distance away from the wound. Upon its removal, in thirty-six hours, a passage is left separated from the peritoneal cavity, which would provide exit for infectious material and guard against infection travelling from the bladder to the general peritoneal cavity. He was sure this method of thorough isolation of the wound would save some cases which would otherwise die of infection.

DR. GEORGE ERETY SHOEMAKER commented upon the use of the Trendelenburg position. Because of its acknowledged tendency to spread any infective fluids which may be confined by gravity to the lower abdomen, the question arises whether, in

dealing with such cases, it might not be wiser to thoroughly flush immediately after opening the abdominal cavity, pack with gauze, and then raise the patient before suturing.

It had been shown by the catheter that the bladder was empty, and no further escape from it into the peritoneal cavity need have been feared for a few minutes.

DR. DEFOREST WILLARD remembered several cases of gunshot wound of the bladder in the War of the Rebellion; all fatal.

As to lacerations of the bladder, he also remembered one case of litholapaxy, where the stone, after being grasped, moved with fair ease, but seemed to pull upon the bladder in one direction. Symptoms of rupture of the bladder developed immediately with intense pain. This was some years ago, when operations within the peritoneal cavity were not as common as they are now, but even had he opened the abdomen he would not have reached the site of the laceration. The patient died on the second day, and the post-mortem proved the existence of a rent below the line of the peritoneum and between the bladder and the rectum.

As to the great distention of the bladder, it rarely results in laceration. He remembered one case in which the bladder had been in a state of distention for four months. It contained twenty-nine pints of urine, but did not rupture, although it filled the entire abdomen.

DR. ASHHURST remarked, in rejoinder, that it was true that the Trendelenburg position had the disadvantage of allowing fluids to flow back, which was one of the reasons why he did not ordinarily employ it; but he thought that where an organ like the bladder was ruptured, the first indication was to stop the escape of its contents. To begin with washing out the peritoneal cavity, before closing the vesical wound, would not be a very successful procedure. The first indication is to close the visceral wound so as to prevent further escape of urine, and then to wash out the cavity.

As to the use of gauze packing, he did introduce gauze over the wound of the bladder. He would not suggest tightly closing the abdomen where the bladder had been ruptured, and particularly where there had been for some time an opportunity for the escape of urine.

He had been interested in Dr. Allis's remarks as to rupture of the bladder from separation of the bones of the pelvis.

Some years ago he had operated on two cases of penetrating wound of the bladder, one intraperitoneal and the other extraperitoneal, the former patient dying in a few days, and the latter recovering. Peritonitis develops very rapidly in the intraperitoneal cases, and particularly where the urine is of a morbid character. In the case he had just reported peritonitis had already developed before he saw the patient. His history adds one more fatal case to the records of ruptured bladder, but it shows what we should recognize as the proper treatment of these injuries. Even with prompt operative interference the mortality will be high, but it seems better to do whatever is possible than to abandon the patient altogether. With a record of ninety-four deaths out of ninety-eight cases from non-interference we should operate without hesitation, and with our modern methods of treatment we may hope for recovery in a fair proportion of cases.

#### GANGRENE OF THE RECTUM.

DR. H. R. WHARTON reported the case of Miss G., forty-eight years of age, who had been sick for a few days, when he was asked by her physician to see her, on account of some discomfort which she complained of in the region of the anus, where there was some swelling and œdema of the skin. Her temperature had been running about 102° F., and her pulse 116.

Upon examination of the patient, finding marked induration of the skin surrounding the anus, he made a long curved incision on each side of the anus, and exposed gangrenous connective tissue in each incision; he could pass his finger well into the ischio-rectal fossæ on each side of the rectum, and the rectal wall exposed in the wounds was seen to be of a grayish, leaden color, and had a gangrenous appearance. The wound was thoroughly irrigated with a 1 : 2000 bichloride solution, and strips of iodoform gauze were introduced for drainage. The patient's condition remained the same for a few days, and there was discharged from the wounds dark-colored, offensive pus, with shreds of connective tissue.

A few days later examination disclosed the fact that the lower portion of the rectum was gangrenous, and that a perforation had occurred, and that fæcal matter was escaping freely through one of the incisions; the anus and sphincter remained intact, all fæcal matter escaping through one of the wounds. The wounds were freely irrigated, a number of times each day, with a

solution of permanganate of potassium, 1 : 2000. To facilitate the escape of sloughs and fæcal matter he divided the sphincter muscle, and a few days after this a tubular slough escaped, which, on examination, was found to be about three inches of the lower end of the rectum. After this the patient's general condition improved, the fæcal matter escaping freely through the incisions, and the cavity left after the sloughing tissue had escaped was filling up with healthy granulations.

Some weeks after this the patient's general condition had very markedly improved, and she was about to be removed to the country, when, during a very warm spell of weather, she suffered from an attack of heat-exhaustion which almost proved fatal. After this she was removed to the country, but was in a very weak condition, and in a few weeks failed so much that she gradually died of exhaustion.

Dr. Wharton added that gangrene of the rectum, aside from that condition resulting from unreduced prolapsus of the rectum, is a rare condition. The vitality possessed by the rectum, as well as other portions of the intestinal tract, permitting it to be subjected to severe traumatism, without the production of gangrene, and also protecting it against infection. The conditions often observed in strangulated hernia, and in foul abscesses, in close relation to the intestines, where the surrounding tissues are infected and become gangrenous while the intestine remains unaffected, as is often seen in appendical abscesses, are evidences of the immunity which its vitality furnishes. Cripps, Ball and Kelsey, and other writers upon diseases of the rectum, mention gangrenous affections of the rectum, but do not record any such well-defined cases of gangrene of the rectum as the one I have herewith reported. He had only been able to find three other cases similar to the one he had recorded. Dr. J. E. Hulbert (*New Orleans Medical and Surgical Journal*, Vol. vi, p. 72) reports the case of a man of intemperate habits, fifty-two years of age, who applied to him for treatment. The patient had six months before suffered from pneumonia. At the time he came under observation the belly was hard and distended, and he suffered from a mucopurulent discharge from the rectum, with the presence of scybalous masses. This patient, fifteen days later, while at stool, passed a slough from the anus, which, on examination, was found to be the entire rectum, and he died five hours later. Autopsy



revealed the fact that the gangrenous mass passed consisted of the rectum from the sigmoid flexure to the anus.

DR. J. P. JUDKINS (*Ohio Medical and Surgical Journal*, September, 1848) reports a case of inflammation and sloughing of the rectum in a man aged forty-five. The first symptoms were those of irritation at the neck of the bladder, but the patient later passed a small amount of blood from the rectum, mixed with sanious fluid, and on the thirty-second day of his illness a slough, three inches in length, protruded from the anus, being adherent at the internal sphincter. The patient died a month later from exhaustion. A post-mortem examination showed entire destruction of the rectum, from the lower border of the promontory of the sacrum to the anus.

LARREY (*Journal de Chirurgie*, Desault, Paris, 1792, Vol. iv, p. 97) reports the case of a soldier, who applied for treatment for what appeared to be an ordinary urethritis, which responded to treatment. After a few weeks he was suddenly seized with severe colicky pains in the abdomen, followed by vomiting; the pulse became small and intermittent, the patient falling into a state of collapse, and died in thirty hours after the appearance of these symptoms. A post-mortem examination in this case revealed the fact that the rectum was gangrenous from the sigmoid flexure to the anus.

Cases of gangrene of limited portions of the rectum have been recorded by many writers. G. Baumgartel (*Zeitschrift für Wund Aerzte und Geburtshülfer*, 1877, No. 28, p. 104) reports the case of a male, aged forty-four years, who was seized with vomiting and constipation, which did not yield to ordinary measures; there was pain in the left sacral region anteriorly, and the presence of a soft tumor could be demonstrated. On the twentieth day collapse developed, and the patient passed a piece of tubular slough of mucous membrane, three inches in length and two inches in diameter. After the removal of the dead tissue the patient improved, and in six months had recovered, but suffered from stricture of the lower portion of the rectum, which was treated by dilatation.

W. M. A. WRIGHT (*Transactions of the Academy of Medicine*, Dublin, 1885) reports the case of a partial sloughing of the rectum in a woman, aged sixty-five years, which came on suddenly. The patient had suffered from hæmorrhoids for a long time. The

sloughing of the rectum was preceded by an attack of acute inflammation of the piles. There was a marked erysipelatous inflammation of the surrounding tissues, and the formation of a fistula, and later an abscess. The portion of the rectal wall which sloughed was about the size of a half-crown. The sloughing in this case was attributed to the pressure of a mass of impacted fæces. The patient made a good recovery without the formation of a stricture.

N. DAVIS COLLEY (*Transactions of the Pathological Society*, London, Vol. xxxvii, 1886) reports a case of partial gangrene of the rectum, in a man thirty-seven years of age, in which a tubular slough of the mucous membrane of the rectum, three inches in length and two inches in diameter, had been passed by the anus. This sloughing occurred from the use of an enema consisting of an ammonia mixture and liquor ammonia. This patient recovered with a stricture, which gradually improved under dilatation, so that he passed natural movements.

As far as the reports of the cases show, complete gangrene of the rectum has always been fatal. If, however, a patient suffering from gangrene of the rectum should recover, the stricture resulting would probably cause, sooner or later, symptoms of intestinal obstruction, so that a colostomy would be required. After this, if too large a portion of the rectal wall has not been destroyed, and the sphincter remained intact, it might be possible to dissect the rectum loose, and bring it down and attach it to the skin.

In cases of gangrene of a limited portion of the rectum, recovery usually takes place, the patients in most cases suffering from stricture of the rectum, which seems to have been amenable to the treatment by dilatation.

DR. WHARTON also related the following two cases of gangrenous proctitis: Miss C., aged forty-five years, was said to suffer from hæmorrhoids, and was under the care of an irregular rectal specialist, who, under nitrous oxide gas, dilated the sphincter, and probably made some application to the hæmorrhoids. She returned to her home in the country, a few miles from Philadelphia, and suffered so much pain in the region of the anus that upon the following day she sent for her family physician. Dr. Wharton was called to see her with her physician on the third day after the operation of dilatation of the sphincter, and found

her suffering from great pain in the region of the rectum and the lower part of the abdomen; the belly was distended and tender on pressure, temperature  $103^{\circ}$  F., and pulse 120.

Upon examining the anal region the tissues were swollen and of a dull red color. The swelling and induration extended well out upon the buttocks. No localized spot of suppuration could be found, but upon pressure over the indurated tissues crepitation could be elicited.

The patient was etherized, and long, curved incisions were made through the indurated tissues on each side of the anus, outside of the line of the sphincter muscle, opening freely the ischio-rectal fossæ. Upon exposing the connective tissue it was found to be of a dull gray color, and there was discharged a little thin, grayish fluid. The finger passed into the incision could be carried around the rectal tube and brought up as high as the promontory of the sacrum. The connective tissue, which was found to be gangrenous throughout, was broken down with the finger, and the wounds were then freely irrigated with a 1:2000 bichloride solution; two large rubber drainage-tubes were then carried to the depth of the wound, and also a few strips of iodoform gauze were loosely packed into the wound, to secure additional drainage, and a gauze dressing was next applied. On the following day the temperature was normal and the patient was entirely relieved of pain. For some days, however, large sloughs escaped from the incisions, and, after the sloughs had escaped, the wounds were covered with healthy granulations, and the patient made a good recovery.

Mr. B., aged fifty-four years. This patient was also under the care of an irregular rectal specialist for hæmorrhoids, and was operated upon December, 1897. The treatment in this case, as far as could be ascertained, was probably an injection into the hæmorrhoids. On the day following the injection the patient suffered considerable pain in the region of the anus, which kept him from going to his business. He remained at home for a few days and suffered severe pain, and also developed a considerable amount of fever. Five days after the treatment he sent for his regular medical attendant, who feared the formation of an ischio-rectal abscess, and applied hot dressings, and on the following day made an incision into the indurated swollen tissues in the region of the anus, but no pus escaped.

On the next day, the seventh day after the original treatment, his condition was so unfavorable that Dr. Wharton was asked to see him with his physicians. His temperature at this time was 106° F., his pulse 140. The patient suffered intense pain in the region of the anus. The tissues in the region of the anus were swollen and indurated, the induration extending well out to the gluteal regions, and was so marked in the perineum as to cause the retention of the urine, and great difficulty in the introduction of the catheter.

The patient was etherized, and long curved incisions were made through the indurated tissue in the region of the anus, and these incisions exposed dark-colored, gangrenous, cellular tissue. The finger could be introduced through these incisions and passed completely around the rectal tube. The wounds were thoroughly irrigated with bichloride solution, and rubber tubes and gauze drains were introduced. The patient improved rapidly after the incisions were made, the temperature soon becoming normal. Large sloughs of cellular tissue were discharged from the wound for some time, but after several weeks the wounds were covered with healthy granulations, and the patient ultimately made a good recovery.

Gangrenous periproctitis is a much more common affection than complete gangrene of the rectum, but he had thought it worth while to report these two cases of this affection, from the fact that in both the disease developed shortly after some local treatment by irregular practitioners; that the patients were extremely ill at the time of the operation, and from the fact that the treatment by free incision apparently arrested the gangrenous process, and possibly saved the rectum itself from gangrene, and was followed in each case by satisfactory recovery.

He regretted that in these cases he did not have with him the means to have a culture made, so that the definite infection in each case could be ascertained. In the first case the rapidity of the gangrenous process, and the presence of air in the cellular tissue, as evidenced by crepitation, which could be well demonstrated, pointed to the possible infection of the tissues by the bacillus of malignant cedema, or more likely by the bacillus *aërogenes capsulatus*.

DR. OSCAR H. ALLIS said that sometimes only a partial gangrene takes place and the lateral portion is involved. He re-

membered a case, which was supposed to have had typhoid fever, in which a considerable portion of the lower end of the bowel was involved. The patient recovered with a one-sided scar about the lower third of the rectum, involving a lateral half of the sphincters. No trouble is experienced when the bowels are in good condition, but a diaper is necessary in case of diarrhoea.

He related the case of a girl, twenty years of age, who had suffered a great deal from inability to move the bowels, when examination revealed an intussusception within reach of the finger when inserted into the rectum. A soft catheter was passed through the constriction and relief obtained from the accumulation of gas.

He would like to know how low down intussusception could take place; for example, could it occur as low as the upper third of the rectum?

DR. JOHN ASHHURST, Jr., said he had never seen a case of gangrene of the rectum itself, but he had seen gangrenous inflammation of the tissues around the rectum, especially in connection with diabetes. He had also observed a similar condition in cases of neglected ischio-rectal abscess, and it may be a complication in advanced cases of granular degeneration of the kidney.

In reply to Dr. Allis's question, it may be said that even in ileo-cæcal intussusception the bowel may protrude from the anus, and that in the complete form of rectal prolapsus, met with in children, there is actually an invagination of the rectal walls.

DR. R. H. HARTE said that he had seen one typical case of gangrene of the rectum in consultation with a colleague at the Pennsylvania Hospital. Some error was made in giving an enema during which the man complained of intense pain. Six hours after the enema had been given the parts were enormously swollen far up into the bowel. The patient died in the course of a few weeks of peritonitis and was very much exhausted. He believed it was a case of gangrene of the rectum, although, maybe, not complete.

DR. DEFOREST WILLARD said that after the injection of hæmorrhoids with carbolic acid many cases are followed by results similar to those related by Dr. Wharton. He was recently called out in the night to an old gentleman who had thus suffered at the hands of one of these quacks and found him moribund and

delirious. Almost the entire ischio-rectal fossa was in a gangrenous condition, and exuding from the anus was a very offensive fluid. He made a number of incisions, but the patient died before morning. He did not think surgeons could speak too positively about this matter when so many wonderful cures are falsely reported as following these injections.

He remembered a fatal case similar to Dr. Harte's, in which a woman had been given an injection into the rectum, and the point of a syringe had perforated the tube. The injection consisted of turpentine, and had been thrown into the abdominal cavity.

DR. WHARTON said, in rejoinder, that in both of his cases he made a rectal examination and satisfied himself that there was no intussusception.

He reported the cases of gangrenous proctitis, because they had both been operated upon by unqualified practitioners, and in one the injection was of carbolic acid, while in the other stretching of the sphincter was resorted to. In treating hæmorrhoids by injection one great danger is sloughing of the rectum and tissues of the anus, which will give rise to a very troublesome stricture. A few years ago he saw a man who had received a carbolic injection for hæmorrhoids, and the whole tissues in the region of the anus seemed to have sloughed. Cicatrization occurred and so tight a stricture resulted that only the tip of the little finger could be admitted. He dissected out the cicatricial tissue, and found that the sphincter had not been destroyed, so he brought the mucous membrane down and stitched it to the skin, with a good result.

#### SEPARATION OF THE UPPER EPIPHYSIS OF THE HUMERUS.

DR. H. R. WHARTON read a paper with the above title, for which see *ANNALS* for October, 1898.

## EDITORIAL ARTICLES.

### VON HACKER ON ŒSOPHAGOSCOPY AND ITS CLINICAL VALUE.<sup>1</sup>

ACCORDING to this author Mikulicz was the first to devise a satisfactory instrument for inspection of the œsophagus. Hacker now uses this instrument, consisting simply of a straight tube, in preference to all the recent more or less complicated devices. Reflected light, such as is furnished by the Leiter panelectroscope, is employed; a 20-per-cent. solution of cocaine having been applied to the mucous membrane, the examination is conducted with the patient lying on his back. This position is the most comfortable if the examination is long, and prevents the secretions from flowing into the larynx. Moreover, the passage of the instrument is directed by the operator and not by its own weight.

The principal points of interest in an œsophagoscopic examination are: the appearances of the mucous membrane, the shape of the lumen at various points, and the motor phenomena seen in the œsophageal wall. The mucous membrane is of an uniform pale-red color; the surface is moist and smooth. Under normal conditions deep longitudinal furrows are not seen; on the other hand, a transverse ridge and a slight horizontal depression may be found on the widest portion of the posterior wall.

The appearances exhibited by the lumen of the œsophagus vary considerably at different parts of this tube. The upper opening is completely closed by the action of the inferior constrictor of the pharynx. This closure can be readily appreciated when one slowly withdraws the tube from the œsophagus, the lumen becoming obliterated the moment the tube passes out of it. In

<sup>1</sup> Beiträge zur klinischen Chirurgie, Band xx, Heft 1.

the cervical portion a rounded, occasionally transverse opening is seen, expanding and contracting, as in all portions of the œsophagus, with the respiratory movements. When the instrument passes into the thoracic portion, one gets the impression of looking into a longer canal, and this appearance is specially marked in the widest portion below the bifurcation of the trachea. At this point, during expiration, a species of spherical triangle or polygon is formed by the bulging inward of the walls. Just below the bifurcation an internal bulging is often seen even during inspiration, anteriorly and to the left: this appearance is probably due to contact of the œsophagus with the left bronchus. At the diaphragmatic opening the lumen is converted into a narrow slit, running obliquely from the right posteriorly towards the left anteriorly; sometimes the stellate appearance seen just within the entrance of the œsophagus is duplicated.

Respiratory movements may be seen in the normal œsophagus, the walls expanding and collapsing in inspiration and expiration. Pulsation is observed chiefly in the lower thoracic portion anteriorly, where the œsophagus comes in contact with the pericardium. A peristaltic wave may occasionally be observed during efforts of swallowing, gagging, and vomiting.

The important diseases in which œsophagoscopy can be applied with advantage are inflammatory states and their sequelæ, constrictions, dilatations and diverticula, new growths and foreign bodies. In the acuter inflammations we have redness, swelling, relaxation of the mucous membranes, and hyperæmia of the blood-vessels. On the contrary, in the anæmic state, such as accompanies cancerous cachexia, the œsophageal mucous membrane displays a striking pallor. Chronic catarrh is manifested by a whitish, œdematous discoloration of the mucous membrane, with thin, slimy or viscid secretion and venous stasis, these appearances are especially marked in alcoholic subjects. There is also frequently some dilatation of the canal. In such patients symptoms similar to those attending a beginning carcinoma are sometimes complained of. In these conditions the œsophago-



scope will demonstrate conclusively the absence of stenosis from a new growth. It is, however, not so easy to eliminate the existence of a carcinoma situated at the cardiac orifice.

The œsophagoscopic appearances of stricture due to the action of caustics is usually characteristic. In the upper portion of the canal one sees longitudinal or dotted cicatrices standing out white against the pinkish backgrounds. If the scars are covered by epithelium they are smooth and shining, and are usually thin and depressed below the level of the adjacent mucous membrane. The intensity of the scarring is most marked at the beginning of the œsophagus, diminishing in extent from above downward. A beginning annular stricture appears as more or less of a cicatricial funnel, with a round or oval lumen at its lower end. The cicatricial portion seldom exhibits any respiratory motion, and none is ever seen in the deep-seated scars. During the examination of these strictures one can often pass bougies and dilators into the strictured portion when previously impossible to do so. The operator is also enabled to locate the opening of false passages, and to see and extract foreign bodies impacted at the point of constriction.

Stenosis of the cervical portion from compression of a goitre and from pronounced lordosis have been recognized by the œsophagoscope. In such cases the œsophagoscopic picture enables us to exclude the presence of a growth originating in the mucous membrane, but not of one with its starting-point in the submucosa.

An opportunity to study the appearances of a true diverticulum was only obtained once. The tube passed into the diverticulum as if into a trabeculated mucous sac with walls covered by an abundant mucous secretion. A clear view of the opening into the œsophagus was not obtained. The examination under these conditions is attended with considerable difficulty. While the location of the opening of the diverticulum is greatly to be desired, its accomplishment is far from easy.

The conditions in which œsophagoscopy possesses the most

importance, either from the stand-point of diagnosis or of treatment, or of both, are cancer of the œsophagus and of the cardiac portion of the stomach, and foreign bodies occurring either in the healthy or diseased organ.

In the majority of cases of œsophageal disease the important feature, from the surgical stand-point, is in regard to the presence or absence of a carcinoma. The disease is seldom recognized when it occurs, as it does not infrequently, in comparatively young persons. The same remark applies to the flat form of growth producing little diminution in size of the lumen and correspondingly few symptoms. Likewise in cancer of the cardiac end, where one fails to appreciate the resistance encountered by a bougie at that distance, as, in the absence of careful measurements, one is led to believe that the instrument has already passed into the stomach.

The appearances in carcinoma naturally vary with the duration of the disease, its direction, and extent. The situation of the growth at the various levels does not modify its aspect. Before ulceration and proliferation of the growth have taken place the appearance is chiefly that of an irregular narrowing of the lumen due to the infiltration of the mucous or submucous tissue. When the mucosa is the seat of the original infiltration, one sees a nodular prominence on the œsophageal wall which shows at that point little or no respiratory movement. The superficial covering is smooth as if stretched out over the nodule; it is usually of a paler color, but may be of a yellowish or cyanotic red color, and plainly distinguishable from the relaxed and injected appearance presented by the mucosa in an inflammatory condition. In stenosis due to infiltration of the submucosa the œsophageal surface may appear normal.

In the comparatively rare cases, when all there is to see is stenosis from infiltration, a positive diagnosis of carcinoma cannot be made, although this has finally proven to be the condition in all of the author's cases. A more or less circumscribed, elevated, and dense induration, with accompanying changes in the

mucous membrane, will probably prove to be a carcinoma, while a more regular prominence, the mucous membrane being normal, will more likely be due to compression from without. We may have in addition patches or streaks of white, shining, epithelial thickening around the affected area. These spots, like the lingual leucoplasia, may be present independently of any growth, but occur most frequently where one is present. In most cases coming under observation ulceration has already set in, and the œsophagoscopic picture is quite characteristic, varying, of course, in accordance with the extent of the disease.

A diagnosis may frequently be made at the first examination: additional information may be gained by the removal of protruding tissue. The taking away of even a quite small portion will frequently alleviate the painful deglutition. In like manner the removal of foreign bodies that have become lodged at the point of constriction gives marked relief.

Œsophageal inspection has demonstrated that cancer is situated most frequently in the middle portion, refuting the old idea that it occurs most frequently at the lower end,—disease at the latter point, in the absence of a direct examination, having been confused with malignant growth at the cardiac end of the stomach.

The larger foreign bodies are generally plainly recognizable as they differ in color from the œsophageal wall. In looking for the smaller objects one must remember that they may be concealed by the mucous membrane being pushed down over them by the passage of the tube; they are best seen when the tube is withdrawn slowly. Evidences of pressure in the neighborhood of the body will often be obtainable. Large foreign bodies are most generally lodged in the upper thoracic portion. When attempts to dislodge them have been made, they have generally been found below the bifurcation of the trachea and at the diaphragmatic opening. In twenty-five cases where removal of foreign bodies by the help of the œsophagoscope was attempted, the author experienced only one failure.

With regard, therefore, to the clinical value of the œsophagoscope, it may be said that œsophagoscopy is above all a means of diagnosis, and in addition is frequently of great therapeutic value. With its assistance one can generally recognize the presence or absence of injuries and inflammations of the mucous membrane, especially when due to the passage or infection of foreign bodies. In many cases of marked disturbances of deglutition its use enables us to determine with considerable certainty the presence or absence of a new growth at a point of obstruction. In addition, chronic catarrh, pathological stenosis, partial dilatation, external pressure, cicatricial stenosis, or foreign bodies may be diagnosed by its use.

Employed as a therapeutic measure, portions of proliferating tissue may be removed and caustics applied to a cancer; in cicatricial stenosis a diminished lumen may be found or a false passage recognized, in either case one can resort to dilatation and the removal of impacted bodies.

Carcinoma is the most frequent affection of the œsophagus, and it is of the greatest importance to be able to make a diagnosis at its early stage. This timely recognition will, perhaps, be attended with still greater importance, should future improvements in operative technique give us the hope of attaining a like measure of success that has obtained in modern intestinal surgery.

CHARLES L. GIBSON.

#### KÖNIG ON CYSTIC ENCHONDROFIBROMATA AND SOLITARY CYSTS OF THE LONG BONES.<sup>1</sup>

RECURRENCE of osseous sarcomata, even after amputation of the affected limb, being exceedingly common, the importance of recognizing certain non-malignant tumors which closely simulate them is of great importance. The non-malignant tumors alluded to, when arising from the inside of such bones as the

<sup>1</sup> Dr. Fritz König, assistant in the Surgical Clinic in Berlin, *Archiv für klinische Chirurgie*, Band lvi, S. 667.

shaft of the femur, are rare. Fischer states that "large, nodular, hard tumors of slow growth occur as fibroids, arising from the periosteum, the medulla, and rarely from the articular ends of the long bones." König says, "I have removed benign bone tumors from the femoral shaft and several of great extent from the surface of that bone."

Tillmanns considers cystosarcomata as the least malignant of the sarcomata. They grow slowly, distending, and then breaking the bone. It is by no means impossible that benign cystic fibromata have been included among these tumors since the frontier between fibromata and sarcomata is not easily made out. Central enchondromata of the long bones have given rise to more literature. Virchow has studied them from the stand-point of anatomy and etiology. In his text-book on tumors he says, "Foci of cartilage may remain dormant inside the bone, developing later and forming the starting-point of enchondromata." In 1864, 1875, and 1880 the same author showed that such cartilaginous foci could be entirely separated from normal cartilage. He considered that they consisted of dormant, snared-off portions of the epiphyseal line, and explained the origin both of cartilaginous exostoses and of central enchondromata.

Leroni (1893) supports this view from a study of a specimen obtained in Orth's institute.

One is always inclined to extend a well-known etiological principle to other tumors. This is true in the case of bony cysts of the long bones. Bone cysts (as distinguished from various other cysts in bone) have the following characteristics: They occur in the tubular bones and form a unilocular or multilocular cavity in the shaft near the epiphyseal line; they increase in size concentrically, slightly distend the bone, until in places it is as thin as parchment; as a consequence the bone may bend or even spontaneously fracture. Inside the cyst there is a turbid or bloody serous fluid, the wall has a more or less smooth covering on which are attached a few remnants of tissue differing in type from surrounding structures.

Virchow has said (1876) that all bone cysts are the result of softening and degeneration of solid tumors, and that the cysts under consideration arise from remnants of the epiphyseal line left as erratic pieces of cartilage in the bone marrow. He was able to recognize small portions of cartilage attached to the inner wall of a bone cyst. This explanation has been subsequently accepted, and Schlangé, who was the first to give a distinct and impressive description of the clinical aspects of these cysts, also recognized cartilage in them, even though it was in very small quantity and sometimes of the fibrous variety.

Bone cysts occur generally during the time of active bone development,—*i.e.*, at puberty or in childhood. The disease begins insidiously. In one limb—*e.g.*, the thigh—there begin slight and varying pains. There is slight lameness. Mobility of the joint is unimpeded; there is no visible abnormality. Palpation reveals nothing but perhaps a point of tenderness,—*e.g.*, below the trochanter. Recovery apparently ensues, but limping returns. The leg seems shorter, and examination reveals a convexity of the bone immediately below the trochanter. Months or even a year or two later the patient sustains a fracture at the spot which has been only painful up to this time. The fracture follows some entirely insignificant trauma.

From this time on the history of cases may be very different. In one case there may be but slight effusion of blood, the bone is bent at the affected point, but its circumference is not much altered. There is scarcely any swelling. At some spot the bone becomes so thin and soft that it can be bent in by the finger like parchment. The condition is still clearer when, fracture being absent, the site of the disease is recognizable from the bending of the bone and the excessive tenderness on pressure. The bone is scarcely enlarged, and only the educated finger recognizes the process at work inside it. Should an incision be made at this stage of the disease and the well-preserved periosteum be reflected, a yellow or bloody serous fluid will be seen flowing

out through the thin plate of bone covering the cyst. This fluid comes from a cavity in the bone, on the wall of which are to be seen pieces of tissue, sometimes brownish in color, sometimes blue like cartilage. The cavity may be divided by septa. The walls having been removed healthy bone is reached, and in appropriate cases the epiphyseal line may be seen beside the cyst, but remaining intact. The wound gradually closes, the bone becomes firm, and all is well.

Such is the simple bone cyst. The fluid in the smooth-walled cavity is the most evident pathological condition. The scanty remnants of tissue adhering to the cyst wall remind one, though with difficulty, that a neoplasm has been present, from which the cyst developed.

Quite another picture is seen in cases where complaints have been made for one or two years, and nothing definite found, on examination, until the bone has become fractured after some slight injury. Here there is found, besides the local signs of fracture, much circular swelling at the site of fracture; even after the hæmorrhage and infiltration has disappeared a distinct tumor remains, which involves the femur alone, and can only owe its origin to a central tumor. Wherever such an uneven swelling of the bone is found, the bone substance is thinned so that it may be indented by the finger and indistinct fluctuation is made out. The clinical picture of such a cyst is very different from the preceding, yet its development and result are the same. It is much more liable to be mistaken for a sarcoma, since the development of the cyst is overshadowed by the great growth of tumor tissue.

Cases where tumor tissue has early liquefied are much more suitable for the study of the development of bone cysts than are such cases as have been described. As suitable cases for such study are very rare, the author gives a very extended account of one which was admitted to Bergmann's clinic in 1895. The patient, a girl of fifteen years, had complained of pain in the left leg for two years. Occasional lameness. Examination by a

practitioner revealed nothing until comparatively recently, when a prominence of the right hip was noted. The pain increased. In August, 1895, patient fell on the level street hitting the right leg. In ignorance of the history dislocation was diagnosed, but reduction was impossible. Patient was sent to the clinic. The following condition was noted: Right leg shortened by two to three centimetres. Motion very painful; contour of hip indistinct. Marked swelling over hip and from trochanter down to lower third of thigh.

Crepitus below great trochanter. Diagnosis: Fracture probably owing to presence of tumor, since injury was slight. Site of fracture not evident on account of swelling. In an extension dressing the fracture united by October 3. By this time effused blood had been absorbed. Examination showed a broad but moderate-sized tumor reaching from the very wide trochanter to the middle of the femur, and causing a uniform thickening of the shaft of the bone. Superiorly the limits of the growth could not be defined. Hip-joint free. Tumor was on the whole hard, although in some places softer than in others. Its form was irregular and surface nodular. Skin was not adherent.

In the absence of the history, diagnosis of central sarcoma with spontaneous fracture would have been justifiable. The fact that union took place would not have contraindicated such a view.

Taking history and symptoms together, Bergmann concluded to attempt local extirpation.

Through a longitudinal incision, after reflection of the periosteum, the prominent masses of bone were gouged away. This gave access to the interior of the tumor, from which the contents of several cysts escaped. The fluid was brownish or yellowish. Some of the cysts were surrounded by bony plates, others by solid tumor masses.

The tumor tissue presented, on the whole, a whitish-gray color, though at many places it had the appearance of whitish



cheese. The consistence was generally hard, but in parts it was softer and even like mucus. The tumor filled the distended bone. A small segment of the shaft having been removed by the chain-saw, it was seen that the medulla of the lower fragment was infiltrated by this whitish tumor tissue. This was removed by the sharp spoon until healthy marrow was reached. The tumor extended upward into the neck of the femur and was scraped out. The wound was tamponed and the limb immobilized in a fenestrated plaster dressing. Healing took place by granulation. In five to six weeks the bone was firmly united and the wound closed. The good result has been retained.

*Examination of Specimen.*—The outer shell of bone is thickened, especially at site of the fracture. Under the corticalis sponge-like masses of bone are seen with the pores filled by whitish-gray tissue. This tissue is continuous with the tumor filling the central canal of the bone. The appearance of the tumor is that of a hard fibroma. Here and there one sees patches of pigment, the result of old hæmorrhages. This tumor reached from near the femoral head to the middle third of the bone, filling the marrow-canal like a plug. Part of the bone shows little external change. That portion of tumor immediately below the trochanter major presents a more complicated appearance. The tumor here contains many cavities, its structure is looser, and its color is brownish. The cavities contain a brown fluid, their walls are smooth, and have the same appearance as the surrounding tissues. In other cysts the smooth walls may be gray in color. Some of the cysts lie close to the bone and have but little tumor tissue around them, some have a bone lining. Careful dissection shows that even those cysts which seem to be free from tumor tissue and to correspond to pure bony cysts are in reality the result of liquefaction of parts of the tumor. Throughout the tumor are seen extravasations of blood, broken-down cells, and patches of mucous degeneration.

Another noteworthy element is to be found in this complex

of tumor, degeneration, and cyst,—viz., hyaline cartilage. It occurs in isolated masses, about the size of a pea, scattered through the tumor. On one side of such masses of cartilage there is a fibrous tissue capsule, on the other side the ground substance is becoming chalky, while the cartilage cells remain normal. Instead of becoming calcified, the cartilage cells become lost in the tumor, which in such places consists largely of spindle and irregular-shaped connective-tissue cells. A few giant-cells are placed like osteoclasts against the chalky zone of the cartilage. In many places nuclei, spindle and round cells are so numerous that in these localities a diagnosis of sarcoma would be warranted histologically.

Simple solitary bone cysts do not admit of such an exact histological description. In them the tumor tissue, when present, is extremely scanty. One must surmise rather than study their development from such origin.

In the Royal Clinic of Berlin only one other case of cystic tumor in a long bone has been observed. This was in a sixteen-year-old girl, and was operated on recently. Individual portions of the growth were so like a sarcoma that a partial histological examination would certainly have led to error. The tumor was a fibroma and benign.

The site of these tumors, viz., the bone, explains their polymorphism, since there is scarcely another organ in which so many varieties of anatomical changes are met.

JOHN F. BINNIE.

## REVIEWS OF BOOKS.

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- (I) *ESSENTIALS OF PHYSICAL DIAGNOSIS OF THE THORAX.* By ARTHUR M. CORWIN, A.M., M.D. (Chicago). 12mo, pp. 200. Second edition, illustrated. Philadelphia: W. B. Saunders, 1897.
- (II) *THE ELEMENTS OF CLINICAL DIAGNOSIS.* By Professor Dr. G. KLEMPERER, Professor of Medicine at the University of Berlin. First American from the seventh German edition. Translated by NATHAN E. BRILL, A.M., M.D., and SAMUEL M. BRICKNER, A.M., M.D. 12mo, pp. 292. Illustrated. New York and London: The Macmillan Co., 1898.
- (III) *ATLAS OF METHODS OF CLINICAL INVESTIGATION, with an Epitome of Clinical Diagnosis and of Special Pathology and Treatment of Internal Diseases.* By DR. CHRISTFRIED JAKOB (Erlangen). Edited by AUGUSTUS A. ESHNER, M.D. (Philadelphia). With 182 colored illustrations, and 64 illustrations in the text. 12mo, pp. 500. Philadelphia: W. B. Saunders, 1898.

(I) Three books have recently appeared, each one of which is designed to furnish aid in the important matter of physical diagnosis. Although each has the same end in view, they differ materially from one another in arrangement, in choice of material, and in the manner of presentation.

Of the three, the little volume of Corwin is of least importance as regards size, and yet in its own sphere will doubtless prove of value. The physical diagnosis of the thorax is the sole topic that is considered. No claim is made for originality in the subject matter, but good judgment is shown in the choice of definitions and descriptions. These are concise and exact, and by means of appropriate type the relative importance of each is

made apparent to medical students, for whom, indeed, the book is especially written.

The topography of the chest, its landmarks, and a description of the various methods of physical diagnosis are of course first to be studied. The remainder of the book is devoted to the physical signs common in and peculiar to each disease of the chest, whether respiratory or circulatory in origin.

As a means of obtaining the essentials of the subject in a brief form the book will be found valuable.

(II) To Dr. Brill and Dr. Brickner the medical profession of England and America are indebted for a translation from the German of Klemperer's "Clinical Diagnosis." The original was written in 1890 as a Jubilee offering to Privy Councillor Professor Dr. E. Leyden, and such is its worth that since that time no less than seven editions have successively appeared. The last of these forms the basis for the present volume.

For the favored few who have access to the best of American hospitals there is no necessity for foreign study so far as surgery is concerned. They will find here the best operators, the best technique, and the best material equipment that the world has to offer. In obstetrics the balance is also inclined in our favor so far as the work of a very few institutions is concerned. But for the student, who wishes to secure the best clinical teachings in internal medicine, there is no doubt that at the present time Germany or Austria offers opportunities and teachers that are far in advance of those to be found elsewhere. Those who are familiar with German methods of instruction in clinical diagnosis will at once recognize the claim that this volume possesses for permanent recognition, for in it are embodied the rules and customs in vogue in the first medical clinic of Berlin.

The necessity for securing a brief and at the same time a comprehensive anamnesis and general history of each case is emphasized at the outset, and a general outline of such an examination is given. From this general basis, which should underlie all such work, the subsequent methods of diagnosis vary

according to the special class of disease or group of organs that are involved in the pathologic process. Febrile, acute infectious diseases and diseases of the nervous system, digestive system, upper air-passages, respiratory tract, circulatory system, examination of the urine, diseases of the kidneys, disorders of metabolism, and diseases of the blood are the titles of successive chapters. Each chapter is an epitome of all that is best in the matter of diagnosis. The tests given are the most recent and reliable. The three closing chapters upon diseases of the blood, the animal and vegetable parasites, and the Röntgen rays as diagnostic aids are especially valuable, as they represent comparatively recent investigations. The careful reader, no matter how well informed he may be upon the subject, cannot fail to gain new and valuable information.

The work of the translators, too, has been admirable. The original plan of Klemperer has been closely followed, and continental terms have been retained. These at first glance will appear strange to the English reader, but the scientific accuracy and uniformity that they secure more than compensate for their drawbacks.

(III) The Germans for some years have been more fortunate than ourselves in having available a number of works which by means of well-executed colored plates give an excellent idea of the methods of clinical investigation, and the results that should be secured by a careful observer. The third of the group of books that we are considering is a reproduction of one of the best of these clinical atlases, with a translation of the text with which it is supplemented.

The plates are by far the most important portion of the volume. The first series embodies the results of clinical microscopy and chemic color reactions. Each full-page plate contains from six to twelve subdivisions. The blood and its various corpuscles, in health and in disease, are particularly well represented; next in importance are the plates illustrating urinary sediments and chemical reactions.

In Part II are included a different class of plates. The normal projection of the viscera and percutory topography are first shown. Following these explanatory outlines are two important series of similar size; in the first are shown the results of respiratory and cardiac diseases; in the second, abdominal diseases. Each illustration embodies the physical signs found in an actual case, and each is accompanied by a brief history of the illness with the treatment and result; they are therefore of great practical value.

Physicians who are in the habit of keeping clinical records of their own patients will find the system of shading and arbitrary signs here employed one that may easily be adopted in private practice.

The epitome of special diagnosis, pathology, and treatment, which comprises the closing section of the book, is good as far as it goes; but it is merely designed to supplement the plates and not to take the place of a larger text-book. Brief therapeutic notes relating to dietetics, hydrotherapy, and physical methods of treatment close the volume.

The plates are accurate and faithful to nature, and the publishers are to be congratulated upon the artistic methods by means of which this condition has been secured. Other similar atlases are soon to appear, and we bespeak for them a hearty welcome.

HENRY P. DE FOREST.

A COMPENDIUM OF INSANITY. By JOHN B. CHAPIN, M.D., LL.D. Philadelphia: W. B. Saunders, 1898.

This little work, of 234 pages, by the physician-in-chief of the Pennsylvania State Hospital, is well adapted to the needs of the medical student, and is certainly comprehensive enough for any non-professional seeker after knowledge. Taken as a whole, it is an excellent and safe guide, though it does not pretend to go very deeply into the subject, and, like the best of works, is subject to criticism at some points.

A certain old-time bias is indicated by this sentence in the

introduction: "The so-called advances in psychology are as yet but interesting physical experiments, or minute analyses and descriptions of mental processes." And the expression, on page 133, "The mysterious periodicity which is noticed in all nature" sounds rather poetic than scientific.

He seems to figure neurasthenia as a frequent forerunner of insanity, a view that, however attractive, is pretty generally doubted by those who have to do more especially with neurasthenic cases.

He makes the statement on page 186 that epileptic seizures are always more frequent at night. This may be true of institutional cases, but it is doubtful if it holds for even a majority of those outside.

A brief chapter on abnormal psychical states is interesting as a recognition of mind-wandering, whether of hysterical or other origin.

Six plates giving sixteen good illustrations of facial types are included. The printing is clear and type large enough for easy reading.

WILLIAM BROWNING.

*ATLAS AND ABSTRACT OF THE DISEASES OF THE LARYNX.* By DR. L. GRUNWALD, of Munich. Edited by CHARLES P. GRAYSON, M.D., University of Pennsylvania. With 107 Colored Figures on 44 Plates. 12mo, pp. 300. Philadelphia: W. B. Saunders, 1898.

The series of Medical Hand Atlases of Lemann, which are now in process of translation from the German, has been increased by the addition of two others since the publication of the Atlas of Clinical Diagnosis, recently reviewed in these columns. The first of these is devoted to the diseases of the larynx, and is the result of the labors of Grünwald, of Munich. Although primarily designed as an aid to the laryngologist, it has a general value as well, for between the conditions of a simple hyperæmia of the larynx and the malignant and terminally fatal neoplasms that occasionally invade that organ, there are many conditions

which the physician and surgeon are called upon to recognize and to treat.

In what may be termed the introductory chapters, the anatomy and physiology of the larynx, and the best methods of laryngoscopy, inspection, palpation, and auscultation that may be required in a thorough examination of the structures of the throat are briefly stated. A hundred pages of text are then devoted to the pathology and treatment of the acute and chronic inflammations, the neoplasms, and the nervous and circulatory disturbances that are observed in this locality.

The essential and important portion of the volume is, of course, devoted to plates and figures. Two classes of lesions are represented,—macroscopic and microscopic. In the former class various laryngoscopic images are the salient features. The lesions which may be observed upon vocal cords, epiglottis, ventricular bands, and even upon the trachea, are shown in colors, showing as closely as possible the conditions as they appeared in an actual patient. To render each plate of still greater value the principal facts of the clinical history are also added. "The illustrations are arranged solely according to external appearances, without regard to the nature of the disease; partly in order to train the eye by comparing conditions similar in appearance, though differing widely in their true nature, and partly to make it easier to find the illustrations which most resemble the particular case to be diagnosed."

The microscopic changes that occur in tissues implicated in disease are deemed of great importance by the author, and in the second group of plates he has included a number of sections drawn from slides typifying the most important diseases. Of these plates those representing sarcoma, carcinoma, tubercular and syphilitic changes are of especial importance.

For some reason the color reproduction falls considerably below the standard established by the former volume. The drawings are accurate but the colors are glaring, and an imperfect rendering of half-tones make the color contrasts much more marked than are seen in nature.

HENRY P. DE FOREST.



ATLAS OF LEGAL MEDICINE. By DR. E. VON HOFMANN, Professor of Legal Medicine at Vienna. Edited by FREDERICK PETERSON, M.D., New York College of Physicians and Surgeons; assisted by ALOYSIUS O. J. KELLY, M.D., University of Pennsylvania. Fifty-six Plates in Colors, and 193 Illustrations in Black. 12mo, pp. 400. Philadelphia: W. B. Saunders, 1898.

Who of his many friends did not lament the untimely death of M. Lecocq, or who of the still larger circle of admirers did not feel a sense of personal loss when his still more famous *confrère*, Sherlock Holmes, was lost forever in the chasm of the Reichenbach! Even now from time to time the thought arises, "Were he but here, this mystery would be solved." If it be permitted those illustrious shades to "revisit the glimpses of the moon," and, perchance, to pass in review before their ghostly minds the series of ghastly crimes so vividly depicted in this small volume, each must be possessed with the vain desire that he might be permitted to add new laurels to his crown by making clear to the world the full history of some of the tragedies which, on these pages, find such graphic expression.

Rape, abortion, infanticide, murder, and suicide, these are the subjects treated in the book. Death by hanging or by gas-suffocation, by the slow action of poisons or by the virulence of vitriol, by the powder-stained wound of a revolver at close quarters or by the destructive action of an explosive bullet, by the delicate incision of a slender Italian dagger, by the gaping wound of the suicidal razor or by the splintered skull of hatchet or sabre at the hands of some European Umslopogaas, all are here, reproduced by the brush or the camera, and faithful to the life, or rather to the death. The "fresh corpse" which Mark Twain so vainly sought, here he could find, and, to give variety, others are shown emaciated by disease, scorched and distorted by flame, torture, or so charred that all semblance to humanity is wellnigh lost. Still others are green from putrefaction, or swollen by advanced decay, or covered by countless thousands

of maggots, or disappearing piecemeal before the onslaught of armies of carrion beetles; still others blue of feature, with sodden hands still clutching bits of straw, or with bodies streaming with the pale and noisome ooze which "covers o'er the slimy bottom of the sea." In such a company the whitened skeleton is turned to with relief as the least grewsome evidence of man's mortality.

No attempt is made to supplant the standard text-books of legal medicine, but rather to supplement them, trusting that the accurate reproduction of actual lesions will enable the physician to become familiar with all gross appearances of medico-legal importance. Accompanying each illustration is an outline of the facts in the case as far as they are known, and thus a valuable standard of comparison is provided and permanent value of the volume insured. Fortunately for civilization, such a collection is a result of years and peoples, and does not, as a rule, embody the experience of a single person. The practical application of the volume must also include the possibility that, by its aid, crimes may be detected and punished by this record of criminal history. This was the doctrine of the departed Holmes, and this is the true *raison d'être* of the work.

For those others, non-professional seekers for sensation, whose delight it is to cower in company about the flickering fire "ere lamps are lit or candles brought," peopling the encircling gloom with ghosts and hobgoblins, or who, through midnight vigils, prefer to sit alone, conning the pages of Poe's "Prose Tales," and feeding their fancies with his weird imaginings, this book will be a veritable boon. Here are facts not fancies; amplify the meagre outlines given of each actual occurrence, supply a motive, and create a hero, and, compared to the resulting series of atrocious crimes, the "Murders in the Rue Morgue" will dwindle to a tale for timid children, and even the feats of yellow journalism will pall to insignificance.

HENRY P. DE FOREST.

ON THE CAUSE AND MECHANICAL TREATMENT  
OF SUBLUXATION OF THE SEMILUNAR  
CARTILAGES OF THE KNEE-JOINT.<sup>1</sup>

By NEWTON M. SHAFFER, M.D.,

OF NEW YORK,

PROFESSOR OF ORTHOPÆDIC SURGERY, CORNELL UNIVERSITY COLLEGE  
OF MEDICINE.

"HEY'S Internal Derangement of the Knee-Joint," occurring as it does both from trivial mishaps as well as from major injuries, and being a not infrequent accident, it seems strange that there should be any doubt as to its essential nature, especially so as Hey wrote his description of the trouble so long ago as 1803. Mr. J. F. Knott, writing in 1882, in the June number of the *Dublin Journal of Medical Science*, discusses the cause of the trouble somewhat at length, and he thinks that there is not so much a dislocation of the cartilage as that "the margin of the condyle is *jerked over* the internal semilunar cartilage." Writing in 1887, in the article "Movable Bodies in the Joints," in "Wood's Reference Hand-Book," Dr. Joseph D. Bryant says: "The nature of the derangement described by Hey is still an unsettled question." A further study of the subject in Allingham's treatise, "Internal Derangement of the Knee-Joint," published in Wood's Medical and Surgical Monographs in 1890, will, I think, dispel all reasonable doubt in the matter. It may be profitable for us, however, to inquire into its exact

<sup>1</sup> Read before the Section on General Surgery of the College of Physicians of Philadelphia, March 11, 1898.

mode of production, but I fancy that the essential nature of the trouble is well understood.

From these and other sources, it may be assumed, I think, that the "internal derangement" described by Hey is occasioned by a varying degree of displacement; by even, in many cases, an imperceptible subluxation of one of the semilunar cartilages. In brief, a visible or manually demonstrated existence of the subluxation is not always necessary. The trouble is so far "internal" that in many cases the ordinary physical signs of a dislocation are not to be observed or felt. I have seen several cases where the trouble was diagnosed as a "sprain," and I know of two instances where the physical signs of the trouble were so inconspicuous that a diagnosis of "an hysterical joint" was made.

A prolonged study of many cases convinces me that, aside from the generally accepted view that this subluxation occurs while the knee is flexed and the leg is rotated, there are other contributive causes which have not been carefully investigated. In short, that it is not the simple fact that rotation of the tibia occurs at the knee during flexion and extension of the joint, for these are normal movements; but rather that there is a delayed or hindered extension and rotation which permits this accident to occur. It would seem, from my studies, that this subluxation is not likely to occur, and I doubt if it ever does occur, except perhaps in cases of violent traumatism, while the quadriceps extensor muscle is relaxed.

Nor is the trouble ordinarily considered as one which belongs to orthopædic surgery. Especially since Allingham's time it has been regarded, I think, as being within the domain of the general surgeon, and so it is in its purely operative aspects. But, as with chronic diseases of the spine and joints, it has its conservative side, and if orthopædic surgeons can offer relief and cure by mechanical means, the general surgeon will, I am sure, welcome their efforts and aid them in their work.

For many years I had pursued the conventional treatment of Hey's joint,—that is, I regarded it as a traumatic, acute joint lesion, from which, as in other acute joint lesions, recovery might be expected with the use of rest, cold, counter-irritants, etc., in a few weeks. I tried to combat the persistent recurrence of the dislocation with knee-caps of various kinds and simple appliances, which, as it turned out, were useless forms of apparatus. When the trouble came back I again resorted to the usual treatment of acute synovial effusions, until Allingham's monograph appeared, and after this period I uniformly referred the persistently recurrent cases to some general surgeon or to some general hospital for operation.

It was a case of this nature—viz., a persistently recurrent trouble—which led me to study the conditions very carefully and critically, and, as the case is an interesting one, I will detail the history somewhat at length, using this case as a text for some comments.

CASE I.—In June, 1891, I was consulted by a young man, Mr. J., aged twenty-two years, who three years previously had been a victim of subluxation of the internal semilunar cartilage of the right knee. The accident producing the trouble had been very simple. He was attempting to board a slowly moving horse-car, and had placed his right foot upon the step, when the car suddenly moved forward. A sudden effort to straighten the knee and to quickly jump on the car produced the subluxation. He was treated by rest and a gypsum bandage, and recovered from the acute symptoms in about four weeks. In various ways and under very simple conditions the accident recurred from time to time up to the day I saw him, when he was suffering from his last attack, produced in this instance by suddenly turning to confront a friend who attempted to play some minor practical joke upon him. After rest, etc., had resulted in a subsidence of the acute symptoms, and I had advised that he place himself under the care of a general surgeon for operation, he appealed to me, asking a further consideration of his case, and begged me to devise some means by which he might avoid the operation.

In looking over the notes of my previous cases I found eight in which the histories were tolerably complete. In these eight the following conditions were present: (1) A very considerable lateral mobility of the joint; (2) an elongated ligamentum patellæ, and (3) in six of the cases an inability to extend the knee completely.

I examined Mr. J. very carefully after considering his appeal for further conservative effort, and I found all these conditions present.

With the knee flexed at a right angle, the distance between the lower border of the patella and the tubercle of the tibia was two and a half inches. It was nearly two inches on the left side. The patella, instead of occupying the usual position in the trochlea with a normal anterior ligament to hold it accurately in its place, was displaced upward fully half an inch. The quick "air-brake" action of the patella on the knee-joint at a given angle, under the influence of the contraction of the quadriceps extensor muscle, is much modified under these circumstances. The clamping of the tibia against the condyles of the former is delayed, and the action of the patella becomes mechanically imperfect, the force being lost obliquely from before backward rather than against the condyles in a line more nearly in the long axis of the femur. The elongated anterior ligament also allows the lower border of the patella to tilt upward, away from the trochlea, as will be seen in the accompanying X-ray picture (Plate I, Case III).

It is, of course, a difficult matter to estimate just how much loss of power results from this abnormal condition; but if we consider the mechanism of the articulation and realize that the sole means of bringing the tibia forward, in the combined movement of extension with rotation, when the knee is flexed, is the quadriceps, and that the force must act through the patella, one can readily imagine that even a slight increase in the length of the anterior ligament must essentially disturb the normal action of the quadriceps upon the tibia as a whole. Add to this an abnormal or greatly increased lateral mobility at the knee, and a further disturbing factor is at once recognized.

The second condition—viz., a great degree of lateral mobility at the affected knee-joint—was also marked in Mr. J.'s

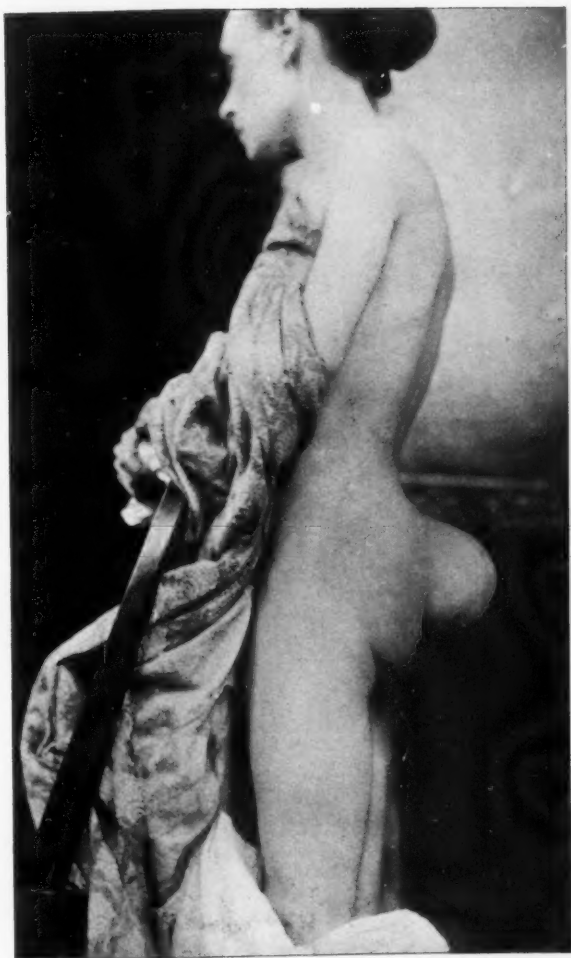


FIG. 1.—Mr. Clutton's case of sacral spina bifida.



FIG. 2.—Sacro-coccygeal tumor, posterior view.

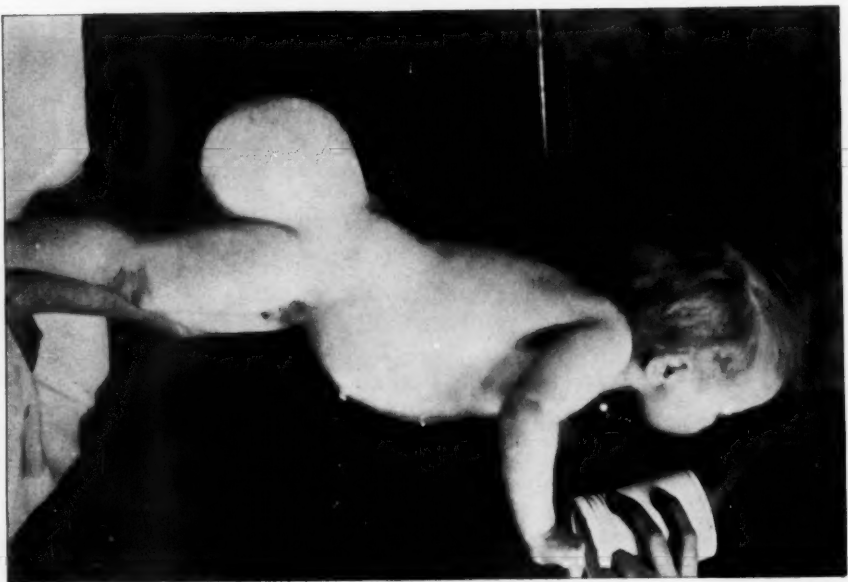


FIG. 2.—Sacro-coccygeal tumor, lateral view.



case. The left knee had no perceptible lateral motion when the knee was extended and the quadriceps was relaxed. This lateral mobility, at the affected knee, was more marked from within outward, or in a direction which, if emphasized, would produce knock-knee. Measured on a large sheet of paper, by lead-pencil tracings, the femur being held, the heel moved through a very considerable arc, which, however, was difficult to measure in degrees. The execution of this lateral "wabble" gave rise to no pain, and, like the elongated anterior ligament, had not been detected by those who had previously examined the joint.

Comparing the conditions found in the affected joint with those on the other side, it did not seem difficult to explain Mr. J.'s frequent subluxations. The normal ligamentous relaxation, which occurs when the knee is flexed, is increased greatly in the condition above described. This alone would favor a slight tibial subluxation, and secondarily a subluxation of the semilunar cartilage, when, in an emergency, the quadriceps makes with the altered patella relation a sudden effort to apply the "air brake" in a semiflexed position. Perhaps the delay in clamping the tibia against the femur is measured, in time, by the merest fraction of a second, but it is enough to prevent a normal completion of the rotation corresponding with the stage of extension, and the cartilage is caught, pinched sometimes only, subluxated at other times, and in some instances "torn in ribbons," as related by Allingham.

The third condition in Mr. J.'s case was also present,—*i.e.*, an inability to fully extend the knee. He was conscious, he said, all the time, when walking, that he "had a knee." Stretched out upon the floor the left popliteal space fell into its normal position, while the right was about one-half inch from the floor. No voluntary effort could bring the limb straight, and force produced at first a most disagreeable sensation, and finally an acute pain. As Hey remarks, "The joint was like a gate with a stone caught in its hinges." There was also in Mr. J.'s case a marked atrophy of the muscles of the thigh, the calf being nearly normal.

From a study of this and my previous cases, it seemed to me that the indications from an orthopædic stand-point were (1) to correct the lateral mobility at the knee; (2) to prevent rotation of the tibia upon the femur; and (3) to so arrange the apparatus

that extension of the knee would stop at a point where the traumatism of locomotion would cease to exist,—that is, at a point where pain and discomfort would be wholly eliminated. This meant an apparatus with simple antero-posterior motion, extending from the upper third of the thigh to the sole of the foot, and with a joint at the knee and ankle, the former having a mechanism by which extension would stop at the desired point.

I at once made a drawing of the apparatus which seemed indicated by the conditions above named. (See Figs. 1, 2, and 3.) In a few days it was applied. The relief afforded was instantaneous. All apprehension regarding the use of the joint was removed. Within a week the patient was walking four miles a day; within two weeks he was playing tennis, dancing, and riding his wheel, and he was in no way incommoded by his apparatus. It fitted so well that, under ordinary circumstances, it did not show through his clothing, and all pain and discomfort were removed. The apparatus was modified from time to time, especially to "coax" the joint into fuller extension, and the pad over the internal condyle was brought closer, thus further modifying the lateral mobility of the knee-joint.

At the end of six months he commenced to discard the use of the brace, at first in the house, afterwards for short walks out of doors, and finally, in the spring of 1892, he dispensed with the apparatus entirely. At my last examination there was normal extension of the knee, very slight lateral mobility, and the ligamentum patellæ had shortened nearly one-quarter inch. The patient had neither discomfort nor disability of any kind.

It seems plain from this case and others which will be related that, in order to prevent the recurrence of a subluxation of the semilunar cartilage, it is necessary to correct the undue ligamentous weakness of the joint, and to prevent an abnormal rotation of the tibia; in short, to give the knee and ankle antero-posterior motion only. Under these circumstances undue strain is taken off the quadriceps and the ligamentum patellæ, and under favorable conditions the latter, as well as the relaxed crucial ligaments, may shorten very materially in the course of a few months.

CASE II.—Miss P., aged twenty years, came under observation in May, 1892. Left knee: First accident occurred when she was eighteen, and resulted from a misstep in getting out of a carriage. It has occurred twice since, the last time while walking across an uneven surface in an uncultivated field. Had the usual treatment in each instance,—viz., a gypsum bandage, knee-cap, etc. Dreads repetition; is constantly on guard and always dreading any sudden movement; cannot fully extend knee; right ligamentum patellæ: two and a half inches; left, two; lateral mobility: right, marked; left, absent. It is three months since her last accident.

Apparatus applied in May, 1892; felt confidence and relief at once; was soon walking, dancing, and wheeling *ad libitum*; no inconvenience from apparatus, which with golf leggings does not show. The patient was so apprehensive of a relapse, and the brace was so comfortable, that she declined to remove it for experimental tests when I advised her to do so. She used it for two years, when, finally, it was discarded with complete recovery. No relapse. Lateral mobility about *nil*; full extension of knee, ligamentum patellæ about one-eighth shorter than when treatment was commenced. Joint firm and serviceable in every way.

CASE III.—Mr. L. N., aged twenty-eight years, in the fall of 1886, while playing foot-ball, sustained an injury to right knee; while giving a "rough tackle" to opponent, the entire weight of his antagonist came against the outer aspect of the knee in a slightly flexed position. "Felt a snap and went down like a shot." Ordinary remedies used; recovered in about three weeks. Six weeks later, while attempting to "kick a goal," the same accident occurred. In four weeks he had recovered. While wrestling in the early winter of 1888 same accident happened. Another month in bed with gypsum splint, etc. In April, 1888, while running to catch a "low fly" in base-ball, he dislocated the cartilage for the fourth time in about two years. The usual time for recovery. In June, 1890, while simply crossing the right over the left leg, he produced the subluxation again. As simple as was the cause, recovery was the most tedious of the series, as he was on crutches for over seven months. Between 1890 and 1897 he was so far recovered that he was able to walk for quite a distance, to play golf, etc., with-

out any recurrence of the accident. But he always felt that he must protect the articulation, and he instinctively kept it in partial flexion when walking. He avoided running, surf-bathing, etc. On November 4, 1897, while getting off from a train with a dress-suit case in his right hand, the case was caught in the arm of one of the car-seats and thrown with considerable force against the slightly flexed knee, which was bearing his weight. The previous condition was reproduced. There was an almost immediate synovial effusion, with pain, heat, and limited motions of the joint. The resistance to full extension was marked, even after all acute symptoms had subsided, and he declined to rest at night other than on his back, so much did he fear that a turn in bed would bring on a fresh attack.

When I examined Mr. N., in November, 1897, just after the last accident, I found the following conditions: Right ligamentum patellæ, two and a half inches; left, two inches; two inches atrophy of right thigh; about one-half inch atrophy of right calf. Lower extremities of equal length; very marked lateral mobility of affected knee; left knee rigid in full extension. Much pain, some heat, and marked synovial effusion.

While the acute effusion, etc., was subsiding, an antero-posterior splint for the leg was made. At the end of ten days the apparatus, limiting all but the antero-posterior movements of the knee and ankle, was applied. He at once walked with comfort and without a limp in this apparatus. In a few days more he was attending to his business, and at present he is able to walk, etc., at will. He has neither pain nor discomfort. He is still wearing his apparatus, and declines to consider any operative interference, although it has been suggested by me. (See Plate I.)

CASE IV.—Mr. K. fell from back of wagon, which started up suddenly on November 11, 1893. Patient says, "My left foot reached the ground before I expected it to, and my weight came upon the bent knee sideways." Very severe symptoms followed; slow recovery; it was nearly two years before joint felt strong again. Had occasional "slips" and pains at various times, and on June 10, 1896, had effusion, with pain, after a decided "slip," as the result of over-exertion. On July 2, 1896, the patient had marked synovial effusion, considerable pain, walked with decided

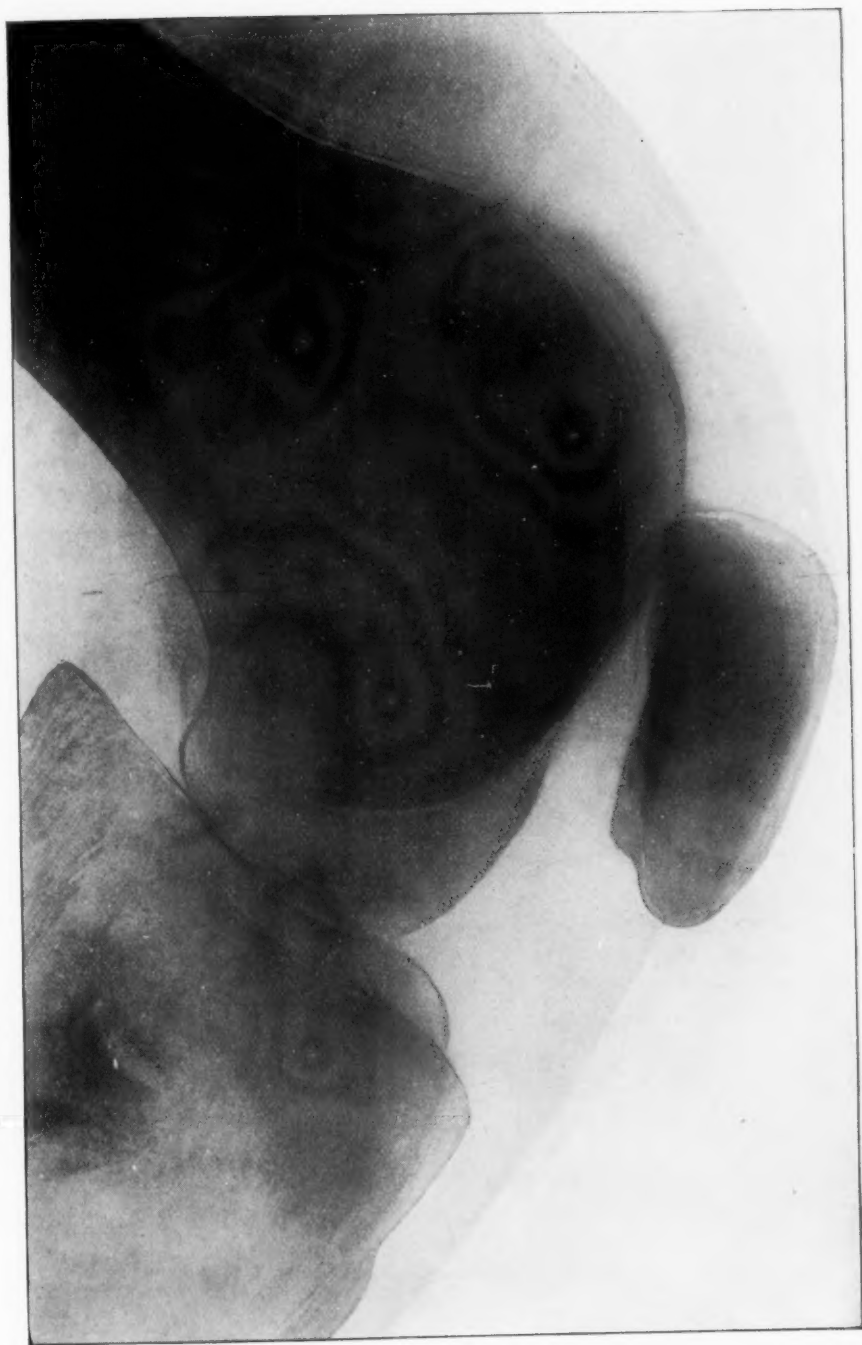


PLATE I.—Case III. - Displaced patella from elongation of ligament.



PLATE II.—Case V.

limp, and felt very much discouraged. Examination showed left ligamentum patellæ two and one-quarter inches; right, one and three-quarters inches; left knee, great lateral mobility; right, none. Measured for apparatus and advised rest, ice, etc., during the construction of the brace. In about ten days apparatus was applied. The relief was immediate. The slight remaining effusion subsided under the protected use of the joint. Patient played tennis, danced, rode his wheel, played golf, etc., within a month from the time of using the apparatus. My last examination showed that though the ligamentum patellæ remained the same length, the lateral mobility was much improved, but was still present, enough so to warrant the further use of the apparatus, whenever the patient takes any unwonted out-door exercise. In the house he discards the brace. He has no pain or discomfort.

CASE V.—Miss K. N., nineteen years old. In October, 1894, while walking across her own bedroom floor, on a level, hard-wood floor, patient slipped and nearly fell, and experienced a sudden "snap." "Something slipped in my left knee, and whatever it was slipped back again when I straightened my leg." Patient felt very faint; swelling and pain, with marked effusion followed. Joint quite stiff. Got well in a month, with rest, elastic knee-cap, etc. Was conscious of something wrong in the knee after recovery; could not fully extend the joint; was on guard all the time unconsciously. The following summer, while in bathing, standing sideways to an incoming surf, a comparative small wave struck the slightly flexed knee. She fell at once and was carried home. Rest, iodine, and a month in bed resulted in recovery. After second accident, going up and down stairs produced pain and often made the patient feel faint. In December, 1895, without any apparent cause, the subluxation was again produced. Water-glass splint this time, with prolonged rest; slow recovery. While romping with her sister in the summer of 1896, a slight lateral pressure on a semiflexed knee reproduced the subluxation. Rest, etc., resulted in a recovery in about a month. Patient consulted me in October, 1896. I found very marked lateral mobility of left knee; right normal. Left ligamentum patellæ, two and one-quarter inches; left, one and five-eighths inches. The tubercle of the left tibia was found to be outside of



its normal position in this case, as if the tibia was rotated outward. Apparatus was at once applied, with a removal of all symptoms. Improvement was so rapid and was so great that it has been difficult to keep up a prolonged protection of the knee. The apparatus was worn spasmodically; very continuously for a week or two, and then discarded until a warning pain or a suggestion of a "slip" brings the patient to a realization of danger. Notwithstanding this, there has been a great improvement. The lateral mobility is much diminished; the knee extension is nearly normal, and patient dances, rides her wheel, etc., with her apparatus on, without any discomfort or without fear of a relapse. (At the date of this writing patient has been without her apparatus for three months without any indication of a relapse, July 17, 1898.) (See Plate II.)

CASE VI.—Mrs. K. Y. B. in November, 1895, was thrown down with right knee flexed and rotated out. Sustained a severe injury to right knee-joint, with a dislocation of the proximal end of the fibula. Had conventional treatment; got around in about a month; was advised to have operation to replace dislocated tibia. In the spring of 1896 made a slight misstep and produced a distinct dislocation of semilunar cartilage. The dislocated cartilage went back "with pistol-like noise" spontaneously. Patient felt a constant dread of a recurrence of the dislocation of the cartilage, she having had several minor "slips" which righted themselves.

I saw Mrs. B. first in February, 1897. A very painful joint. Right ligamentum patellæ, two and one-quarter inches; left, two inches. Marked lateral mobility of injured knee. As in Case V, the tubercle of the tibia was outside of its usual position. Upper end of fibula very loosely held in its position, but not dislocated. Patient feels that it will become dislocated at every step, and seeks advice more on account of the tibial trouble than for relief of knee affection. After explaining the matter to Mrs. B., an apparatus was applied, limiting the knee and ankle to plain antero-posterior motion. Relief was almost immediate, and has been continuous. After six months patient commenced to go without apparatus. The knee symptoms have all disappeared and the tibia is securely anchored in its normal position; its ligaments having apparently shortened the same as do the liga-



PLATE III.—Case VI. Displaced patella from elongation of ligament.





PLATE IV.—Case VIII. Right knee.

ments of the knee under the protection from lateral or rotary strain. (See Plate III.)

CASE VII.—Mrs. M. K. When twelve years old patient slipped in ordinary walking and subluxated the semilunar cartilage of left knee. This was followed by a prolonged hydrarthrosis, and an equally long treatment, which resulted in apparent recovery. Had no further trouble (she is now twenty-nine) until last summer, when, in dancing, some one carelessly stepped on her dress. She felt something slip, lost all power over her knee, and fainted. Two months of rest, bandaging, massage, etc., resulted in recovery. In October, 1897, while playing golf, she made a slight misstep on uneven ground and felt the same "slip," which was followed by intense pain and utter inability to use the knee; was carried to her home.

When I saw the patient, in November, 1897, there was still marked effusion, an imperfect extension of the knee, considerable pain, a wide range of lateral mobility to the knee-joint, an elongated ligamentum patellæ (right, two and a half inches; left, two inches), and the altered relation of the tubercle of the tibia to the long axis of the femur, mentioned in the two preceding cases. Although the patient had pain in locomotion, she insisted on going about, and, after much hesitation, she decided to try the antero-posterior knee and ankle support. Its application was followed by an immediate relief, by a rapid decrease of the synovial effusion under rather extensive use of the joint, and by a removal of all fear of a recurrence of the "slipping," which the patient justly dreaded. She is now dancing with her apparatus on, playing golf, and using her knee, while at the same time it is on its way to complete recovery.

CASE VIII.—Miss M. M., aged eighteen years, came under my observation in the spring of 1897. She gave the history of Hey's joint in both knees. The only case of the kind I have ever seen. The usual signs were present,—*i.e.*, the lateral mobility, the elongated ligament, the recurrent slipping, followed by pain, swelling, and disability. The right knee was less troublesome than the left, and there was a slight difference in the length of the patellar ligament, the left being slightly longer. On the left side the lateral mobility was very marked, being in excess of any other of my series. On the right side it was marked

and about the same as in the cases above recorded. I applied the antero-posterior knee apparatus to either limb in this case, with the usual immediate relief. The braces were not worn continuously, the young lady being absent from home very much, but the relief has been great. With the apparatus on the patient is able to go about at will, over rough ground, etc., and the improvement has been very marked. Latterly the apparatus has been discarded, and massage, etc., has been resorted to with no benefit. The braces have been again resorted to, and the question of operation discussed. It is likely that the operation, especially upon the weaker knee, would have been resorted to had not a very unfavorable report of the results of an operation in a similar case reached the ears of my patient at a critical moment. (See Plates IV and V.)

CASE IX.—Miss G. M., sister of the foregoing patient, aged twenty years, sent for me last May with an urgent message that I come at once, as “in turning over in bed, in the early morning, something had snapped in the knee, which had become ‘locked,’ very painful, and swelled.” I went at once, and was able to feel distinctly the dislocated internal semilunar cartilage of the left knee. Flexing the knee, with some difficulty and pain, to about a right angle, and rotating the tibia outward, I gradually manipulated the dislocated cartilage into its normal position, with an immediate relief to all the painful symptoms. The knee-joint became immediately movable, except that it could not be fully extended. After a few days the swelling had all disappeared, and the patient resumed her ordinary exercises. The question of other than simple bandaging, etc., as a matter of treatment has been held in abeyance, pending an expected repetition of the dislocation, the patient electing this course in spite of other advice.

This is the only case in which I have actually seen and felt the dislocated cartilage, my other patients coming long after the original injury.

I might add that the brother of these young ladies has an occasional slipping of the internal semilunar cartilage, which, he says, has existed from boyhood. Thus far he has suffered only inconvenience from it. I have not examined his knee. (See Plate VI.)

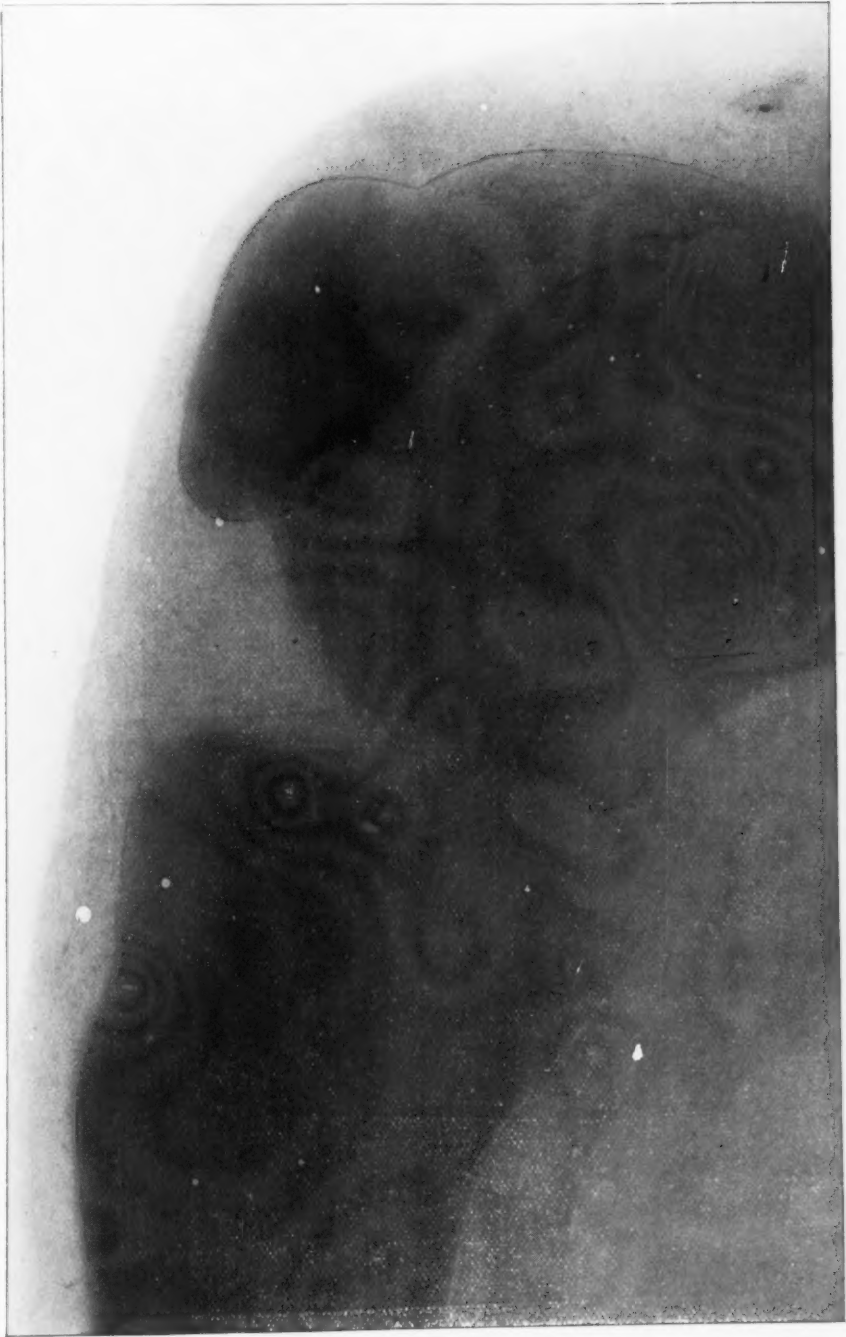


PLATE V.—Case VIII. Left knee.



PLATE VI.—Case IX. Left knee.

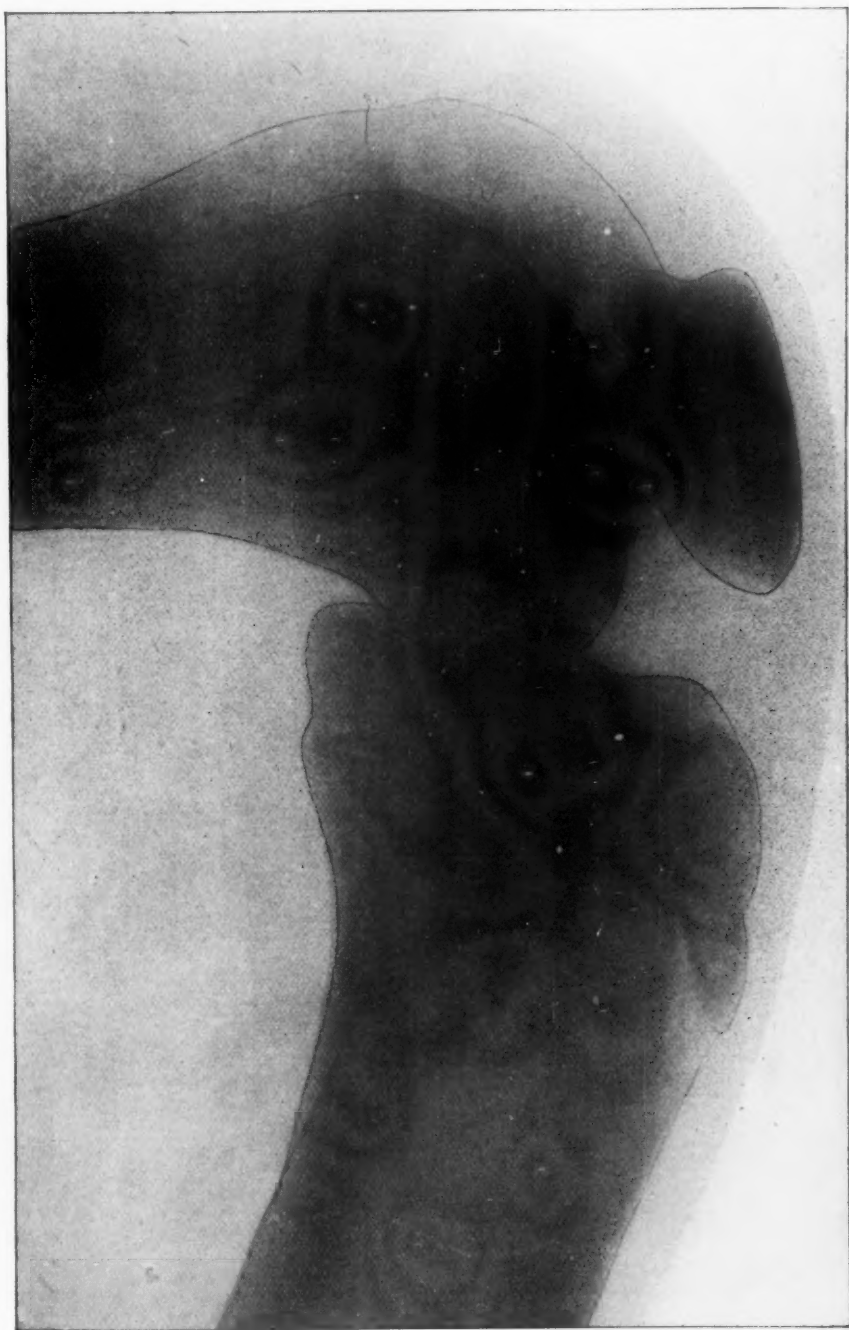


PLATE VII.—Case XI. Slipping patella in a girl of fifteen years; delayed epiphyseal union.





PLATE VIII.—Normal patella of a healthy, active adult, male, aged twenty-six years.



CASE X.—Mrs. B., aged twenty-six years, referred to me by Dr. Arthur A. Booth, of New York City, in April, 1898. Mrs. B.'s trouble dates back fifteen years. Her first attack kept her in the house for fifteen years. In 1892 she became ill, and was in bed from April until October, and during this period of rest the knee evidently became well, for upon recovery from her acute illness she had no further trouble until April, 1897, when the slipping recurred, and since that time she has had very much inconvenience, pain, and swelling. Until lately she was unable to walk over one block. The apparatus was applied and patient at once felt relief. She is now at her home in the country walking, etc., *ad libitum*.

CASE XI.—Miss C. B., aged fifteen years, consulted me in April, 1898, with a history of "slipping patella." She had previously been under my care for ordinary flat-foot. A few days before I saw her, in April, without any apparent cause, the patella slipped, the dislocation being, according to the patient's description, inward, and being easily reduced by the patient herself. The accident occurred, sometimes, half a dozen times a day, but always when the knee was bent with the weight of the body upon it, except on some occasions when she was "climbing a tree or going over a fence." There was no special pain or swelling when I saw the patient, though the joint-outlines were altered and the fossæ on either side of the patella were modified. The ligamentum patellæ was longer than its mate by a full quarter of an inch, and there was present an unusual degree of lateral mobility, such as seen in the cases reported above. An apparatus, such as was used in these cases, was applied, with immediate relief. At first the patella would slip occasionally, but recently, since the support was more accurately adjusted and the pad on the inside of the knee was closely adjusted to the internal condyle, the dislocations have entirely ceased, and the lateral mobility has become modified. I expect this patient to recover in a few months without any operative interference.

I call attention, in this case, to the lack of union at the epiphyseal line at its anterior aspect, as shown in the skiagraph. This may or may not be a contributive factor to the slipping patella. (See Plate VII.)

In order to compare the patellar conditions in a normal

knee-joint with those shown in the accompanying skiagraphs of Hey's joint, I have had an X-ray picture made of a young man, aged twenty-six, with perfectly normal knee-joint. This will be found in Plate VIII.

The location of the patella in these radiographs of the normal knee is clearly shown. It will be observed that the patella lies well down in the trochlea and in close proximity to the head of the tibia. On the other hand, in all the cases of dislocated semilunar cartilage here shown the patellæ are drawn upward, and in some cases the lower end of the knee-cap is tilted upward away from the trochlea. In every case the elongation of the ligamentum patellæ is apparent, and the modified action of the quadriceps muscle can be readily appreciated.

In Figs. 1, 2, and 3 the apparatus used is shown. It is a modification of an apparatus I first applied to a young girl over ten years ago with knee-joint disease, whose name is Campbell, and I named the apparatus the "Campbell traction knee- and hip-splint," after the patient to whom it was first applied. In the present instance the traction rod and pelvic band are removed, the object being not to produce traction, but to prevent every movement at the knee and ankle except antero-posterior motion. In short, to turn the knee into true hinge-joint, removing entirely the rotation of the tibia. In Fig. 1 the apparatus appears unattached to the leg and thigh. The important part of the apparatus, next to its simple hinge movement, is the joint at the knee, which is so arranged that it will stop the extension just at the point of comfort to the patient, and this point of comfort represents an absence of strain upon the knee-joint ligaments. This is very essential to the cure of the trouble, for experience proves that if the strain is taken from the ligaments they will shorten, and the "wobbly" knee will gain stability and strength in a few months.

Figs. 2 and 3 show the apparatus applied, and needs no comment or description. It is important that the centre

FIG. 1.—Apparatus for Hey's joint; antero-posterior motion only at knee and

FIG. 2.—Apparatus for Hey's joint applied; lateral view, showing "stop-joint" at knee.

FIG. 3.—Apparatus for Hey's joint applied; showing protective pad inside of knee.

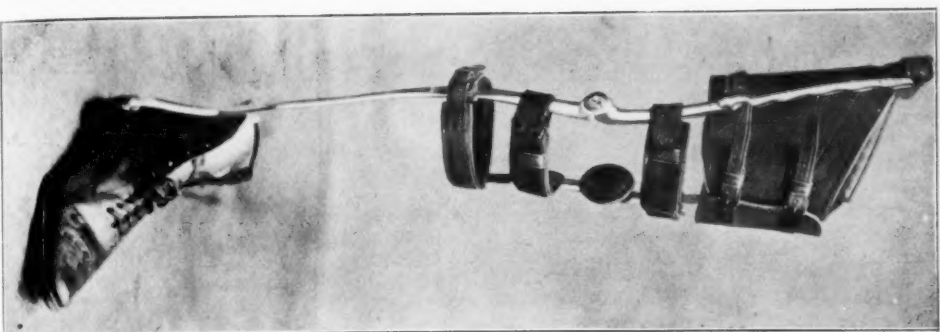


FIG. 1.—Apparatus for Hey's joint; antero-posterior motion only at knee and ankle.

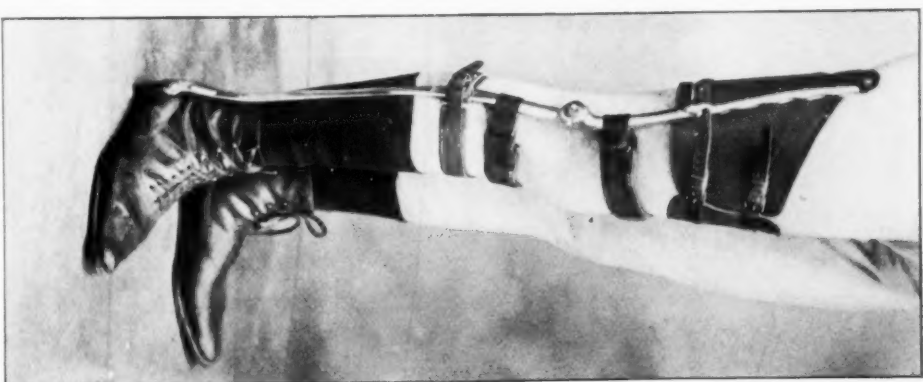


FIG. 2.—Apparatus for Hey's joint applied; lateral view, showing "stop-joint" at knee.

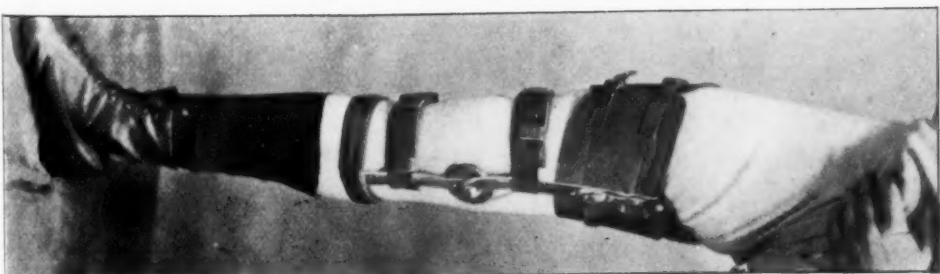
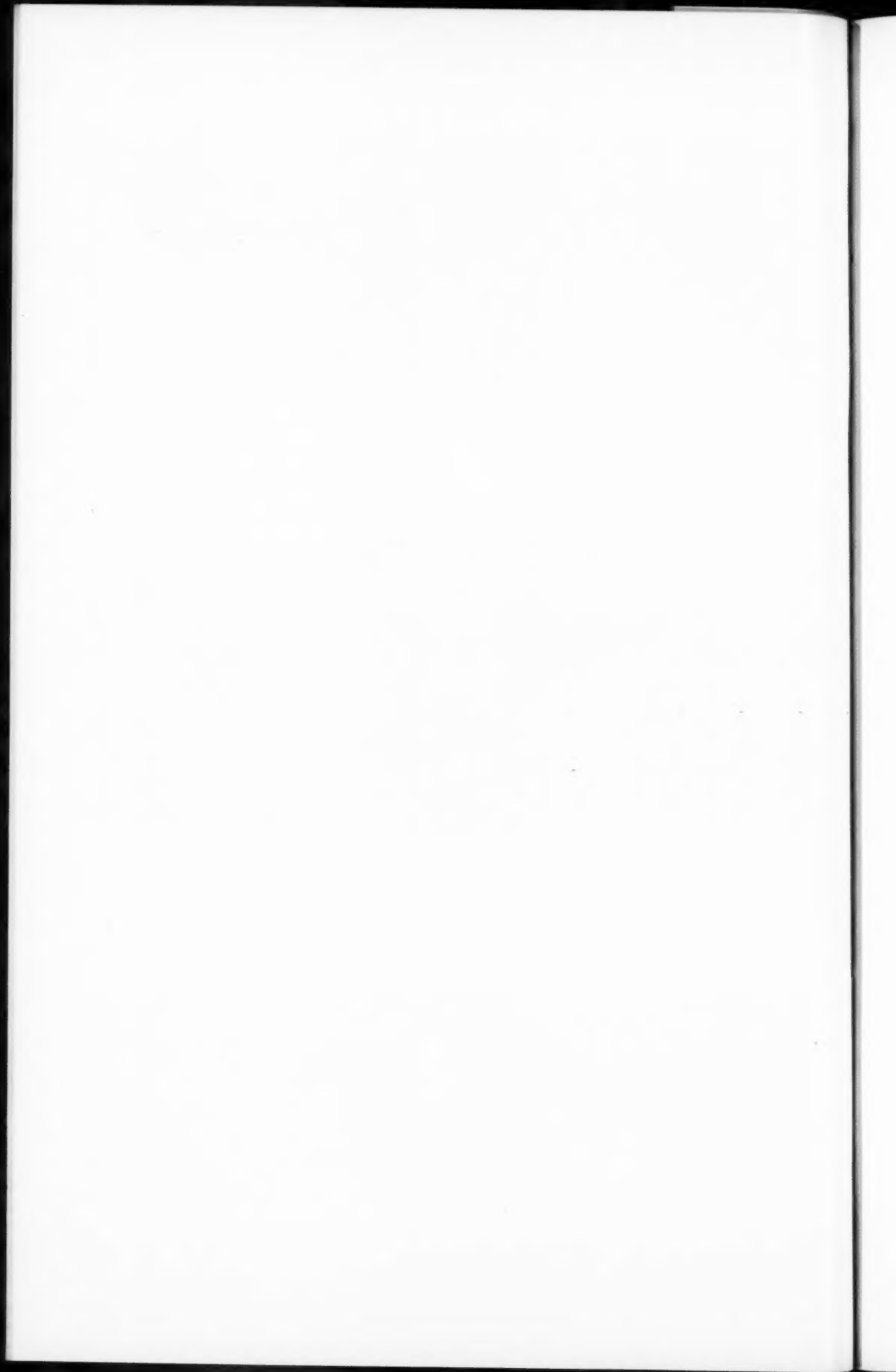


FIG. 3.—Apparatus for Hey's joint applied, showing protective pad inside of knee.



of the pad at the knee should be opposite the true centre of motion (opposite the most prominent point on the internal condyle is near enough) at the knee, and that it should rest snugly against the condyle without undue pressure. The apparatus need not be made heavy, the principal strength being necessary in the rod which connects the knee with the ankle-piece. It is preferable to have this rod on the outside.

I might mention several other cases and facts bearing upon the points raised by the foregoing histories. Those mentioned, however, are sufficient, I think, to establish some facts in relation to the questions raised; and these are, briefly:

(1) In many cases of Hey's joint there is an acquired or, perhaps, congenital lateral mobility of the knee-joint. This condition existing, the normal rotation of the tibia in flexion or extension of the knee is greatly increased.

(2) In many cases, if not in all cases, there exists an elongated ligamentum patellæ, which so modifies the action of the quadriceps extensor muscle upon the tibia that the force of its contraction upon the tibia is modified or delayed in such a way that extension and rotation are not synchronously performed. And it seems more than probable that this condition forms an important factor in the production of the subluxation of the semilunar cartilage.

A simple elongation of the patellar ligament may exist, and frequently does exist, with no outward symptoms except those mentioned in my article "On Elongation of the Ligamentum Patellæ as a Factor in the Production of Certain Knee-Joint Troubles and Difficulties in Locomotion" (*New York Medical Record*, January 16, 1892). I may quote the following brief extract from the paper as bearing on this point:

"I might relate other interesting cases where there was knee trouble due to the lengthened anterior patellar ligament. In some of them there was heat, pain, and swelling, due to overstrain, but no true joint inflammation. In others a sense of weakness and debility. In others a tendency to

dislocation of the patella outward. In all, however, there was a greater or lesser degree of disability under severe, or in some cases ordinary, use of the joint. It was especially noted where much strain was brought upon the articulation in the flexed position."

The various operations for "slipping patella" which have been devised are more or less based on the conditions described in my article, which, so far as I know, is the first stated contribution to this subject.

While, therefore, elongation of the patellar ligament may exist and result only in disability, discomfort, or a slipping patella, it would seem that a further structural weakness of the knee was necessary to produce Hey's joint; and in all my cases, without exception, there has existed, to a marked degree, either a traumatic or an early acquired, lateral mobility of the joint, due perhaps to an infantile rachitis, or to some other cause disturbing bone and ligamentous nutrition in infancy, or in preadolescent life.

On the other hand, a considerable degree of abnormal lateral mobility may exist at the knee, with a normal ligamentum patellæ, without the danger of subluxation of the semilunar cartilage. It would seem as if both of these conditions were necessary to produce the trouble, except, of course, those cases like L. N., where the first trouble was produced by the application of an extreme degree of force. And even in this case the abnormally elongated ligament was a probable factor in the production of the condition.

I cannot close this paper without quoting from Hey's original article, which is a model of clearness and conciseness. He says ("On Internal Derangement of the Knee-Joint," Hey's "Surgery," printed by James Humphreys, Philadelphia, 1805), "The disorder may happen either with or without contusion. In the latter case it is readily distinguished. In the former the symptoms are equivocal till the effects of the contusion are removed. When no contusion has happened, or the effects of it are removed, the joint, with respect to its

shape, appears to be uninjured. If there is any difference from its usual appearances, it is that the ligament of the patella appears rather more relaxed than in the sound limb. . . . The patient himself cannot freely bend nor perfectly extend the limb in walking, but is compelled to walk with an invariable and small degree of flexion."

This most acute observer, under the term "relaxation of the ligament of the patella," calls attention to a condition which I have since called "elongation of the ligamentum patellæ."

Even with the clue given by Hey, no one that I know of has studied this feature of the condition, and as I had not seen Hey's original article until after I had commenced to write this paper, it may be taken as an independent observation confirmatory of the statement first made by this eminent observer.

What Hey saw and thus accurately described, we can now demonstrate with the Röntgen ray.

In Allingham's treatise, already referred to, he says: "A lax condition of the ligaments about the joint, caused by general debility or previous synovitis, predisposes to these accidents, on account of the insecure way in which the tibia and femur are bound together." Again: "The injury is caused by some sudden and almost involuntary movement. Most of the muscles governing the joint are then thrown off their guard or fail to act in concert one with the other."

But I do not agree with Mr. Allingham when he says, "All this may occur even in a healthy joint," if for healthy we substitute "normal," except under circumstances where great lateral pressure is applied, and when a true subluxation of the tibia occurs as a result of direct violence. In several of my cases there was no direct violence. In these cases there existed a condition which I have attempted to describe, and which directly favored the subluxation. And further, the muscles are not "off their guard." The quadriceps acts promptly, but the patella instead of clamping the femur with a normal length of ligament in the trochlea is tilted upward at

the lower end, and the muscular effort is so delayed that the movable semilunar cartilage is caught, perhaps only slightly pinched, or really dislocated, and sometimes seriously damaged.

And my experience proves conclusively that Mr. Allingham is wrong when he says, "The apparatus . . . is cumbersome; but feebly efficient; it cannot cure the affection."

I would rather say of Hey's joint, as well as of many other conditions, that the surgeon would not operate so frequently if mechanico-therapy was as well taught and practised in our medical colleges as is the operative surgery of the present day.



A CONTRIBUTION TO THE STUDY OF HIP-DISEASE. ON THE ULTIMATE RESULTS OF THE MECHANICAL AND OPERATIVE TREATMENT,

WITH AN ANALYSIS OF ONE HUNDRED AND FIFTY CASES OBSERVED AT THE HOSPITAL FOR RUPTURED AND CRIPPLED.<sup>1</sup>

By VIRGIL P. GIBNEY, M.D.,  
JEROME HILTON WATERMAN, M.D.,

AND

W. G. REYNOLDS, M.D.,

OF NEW YORK.

To the collector of statistical data it is unnecessary to offer an apology for any defects that exist or may seem to exist in tables of this character. The tracing of hospital patients is recognized as exceedingly difficult. The shifting population of a large city, and even the towns bordering upon it, makes the collection of facts a task that is not coveted by those who have had experience in this kind of work, yet, it is from a study of such a collection that one gets the most valuable information, and is enabled to make use of the experience gained in hospitals. For several years it has been the aim to follow as closely as possible patients who have been removed or been discharged.

A system something about as follows has been adopted: An envelope is given each patient containing a card with the patient's name, diagnosis, case-book, and page, also date of discharge, with instruction to return at stated times for ob-

<sup>1</sup> Read by title before the American Orthopædic Association at Boston, Mass., May 19, 1898.

servation, and, in addition to this, a circular which explains more fully the directions on the card, and the hospital's willingness to send aid in case the patient is unable to attend. Even with these precautions it is hard to enforce any kind of discipline, so hopelessly irresponsible do some families appear.

In January, 1896, we began a systematic measurement of cases of hip-joint disease that had left the hospital at least five years prior to this date. A study of former statistical papers enabled us to decide upon the data. The aim, therefore, has been to get at all the facts that bear upon the treatment, whether constitutional, mechanical, or operative. Measurements and observations recorded in case-books were not regarded as sufficiently recent, so it was deemed advisable to make personal examinations of the 150 patients, whose cases are herein tabulated.

The following are all the points covered: Name, age on admission to the hospital, sex, side affected, duration of disease before applying to the hospital, hospital or out-door department treatment primarily, the method of treatment before admission to the hospital, condition at first examination, whether acute or not, deformity, abscess, sinus, shortening, motion, the treatment which they received in the hospital and the final result of this treatment, including the angle of deformity, whether acute or not, amount of shortening, abscess, sinus or motion present, and the length of time which had elapsed since discharge from the hospital. It was impossible to record the exact time which the patient remained in the hospital, as many of them were admitted for short intervals, then discharged, and readmitted at some later period, according to the gravity of the case, and the necessity for constant observation. In taking the cases from the record-books of the hospital, each was taken in the order in which it came, provided five years or more had elapsed since discharge, otherwise they were not included. A letter was written to the patients asking them to report for final examination. Many letters were of course returned, great diffi-

culty being encountered in getting the proper address. If, after writing two or three times, no reply was received, another case was substituted for this one. This procedure was necessary in order to obtain 150 cases. Where the patient had died the parents or relatives were asked their condition at the time of death, and in some instances this information was obtained from the attending physician. As a personal examination of these patients could not be made, the results of the last recorded in the hospital books were taken. The inaccuracy of the statements made by the patients in regard to the treatment which they had received at other hospitals made it necessary to note only the methods used in the Out-Door Department of the Ruptured and Crippled, except in instances where they were wearing plaster of Paris or a brace at the time when admitted to the hospital. The early management before coming under constant supervision is associated with many difficulties, more particularly in cases where apparatus is used, for the parents frequently remove it, refusing to have their child wear a brace, and thus the patient is neglected for many weeks, and even months, at a time when strict mechanical procedures should be carried out, in order to guard against as little destruction of the joint as is possible. For this reason plaster of Paris has been found to be an admirable substitute, as the parents are not so likely to remove it, and in the compilation of these statistics the fact is emphasized that the ultimate results were far superior where this had been used in the earlier stages as a means of protection. In private cases, however, it is not necessary to use it to the same extent as in out-door hospital patients, for the former class are constantly under the supervision of the attending physician.

In employing the term cure in this connection, we mean to state that the patients so designated are, to all appearances, free from disease. Treatment has been suspended after a sufficient length of time, and nothing remains as a sequel of the disease other than deformity or shortening. This will include also cases where the function has been re-

stored. A perfect cure is so seldom found in collecting statistics that we have decided not to make use of the term in this sense. The treatment employed has varied. Prior to 1887 apparatus was not used at the hospital. The treatment was spoken of as expectant, meaning thereby a recourse to counter-irritants, such as blisters or liniments and rest in bed or in a wheeled chair. Leeches and the Paquelin cautery were not employed. Since the fall of 1887 the long traction splint has been used in the majority of instances. Weight and pulley on incline plane, fixation in plaster of Paris, correction of deformity under an anæsthetic, and retention apparatus. The treatment, therefore, has been regarded as modern. Supplemental to correction, under an anæsthetic by force, we have employed femoral osteotomy, more frequently subcutaneously; oftentimes an excision of the joint, etc. The operative procedures, therefore, have been all such as require an anæsthetic. Sometimes the mere puncture of an abscess has not been noted on the operation-book. To be more specific, the following are the procedures adopted: Correction by manual force, supplemented often by myotomy, tenotomy, osteotomy, excision, evacuation of abscesses by free incision, and the curettage of sinuses.

In 109 cases the patients had some form of previous treatment before they were admitted, and only forty-one are recorded as having entered without apparatus or treatment prior to admission. Of the series 107 cases are now entirely cured and wearing no mechanical apparatus whatsoever, and are able to follow an occupation without the slightest trouble. All of them have been seen personally at the time when examination was made; twenty-five are wearing apparatus, but a number of these are in such a condition that they could leave the brace off without the slightest danger of a recurrence; but these have not been included in the table of cured cases. Added to these are seven who are going about without apparatus, but who, after a thorough examination, have been advised to return to the hospital for further correction of the deformity,—it being concluded that four might be

benefited by femoral osteotomy and three by attempts at stretching. Eleven have died, all of whom having been discharged from the hospital at least five years. The cause and a full consideration of their clinical condition at the time will be stated later. The disease occurred seventy-one times in males and seventy-nine times in females; and in eighty cases the right hip was involved, in sixty-four the left, and both hips were affected in five cases. The average age at which the disease began was between five and seven years. The youngest child, when brought for advice, was two months old, while the oldest was nineteen years. In five instances the disease was complicated with Pott's disease of the spine; in two it preceded the joint trouble; in three it was secondary to it. In but comparatively few could a definite family history be obtained, for only in twenty-nine of the entire series was the parent's statement in this connection given recognition; and it was found that the father was tuberculous in fourteen, the mother in eleven, and the brothers and sisters in four. A glance at the table will give one an idea of the disposition of the 150 cases.

TABLE I.

Cured . . . . .	107
Still under treatment . . . . .	25
Advised readmission for correction of deformity . . . . .	7
Deaths . . . . .	11
Total . . . . .	150

TABLE II.

*Cases advised readmission for the correction of deformity.*

No.	Final Result : Angle of Greatest Extension.	Shortening.	Present Condition.	Length of Time since discharged from Hospital.
1	140	1 inch	Good motion	6 years
2	145	2 inches	Walks poorly	10 years
3	155	None	Limited motion	17 ½ years
4	140	3 inches	Hip ankylosed	5 ½ years
5	165	1 inch	Hip ankylosed	8 years
6	150	1 ½ inches	Limited motion	6 ½ years
7	150	None	Good motion	7 ½ years

Most of the cases in Table II were either in the hospital at a time when very few operations were performed, or have

been neglected through the parents refusing to bring them at stated intervals for examination, or by removing the braces and discontinuing the treatment without permission. All are now free from abscesses and sinuses, and none of them are acute; and in view of their deformity, every indication is present for some procedure which will correct it.

Of the 107 cases regarded as cured, eighty-nine were acute at the time of the first examination. By the term acute is meant an acute exacerbation. It may be that the acuteness of the exacerbation has nothing to do with the stage of the disease. The eighty-nine, therefore, which were so designated, were not necessarily in the first stage. Indeed, it is seldom that a patient is admitted to the hospital in the first stage. Most of the cases are already well advanced in the disease, and may be getting on comfortably when a slight trauma serves to induce an exacerbation, and for this they come into the hospital. Of the twenty-five cases still under treatment, nineteen were in one of these exacerbations when they first came under observation. All surgeons have long since recognized different grades of the disease. We all know that some cases are more severely attacked at the outset, and that two or more foci may be lighted up simultaneously. We mention this, not by way of apology for the twenty-five that are still under observation, but merely to explain some of these obstinate forms of the disease.

TABLE III.  
RELATION OF ABSCESS TO SHORTENING AT FIRST EXAMINATION IN  
ONE HUNDRED AND FIFTY CASES.

Shortening in Inches.	Abscesses.	Cases without Abscesses.	Shortening in Inches.	Abscesses.	Cases without Abscesses.
0	13	33	3	2	4
$\frac{1}{8}$ - $\frac{1}{4}$	5	7	$3\frac{1}{4}$	0	1
$\frac{1}{2}$	6	11	$3\frac{1}{2}$	0	3
$\frac{3}{4}$	4	5	$3\frac{3}{4}$	3	0
1	2	8	4	1	0
$1\frac{1}{8}$ - $\frac{1}{4}$	3	3	$4\frac{1}{4}$	0	0
$1\frac{1}{2}$	4	7	$4\frac{1}{2}$	2	2
$1\frac{3}{4}$	1	1	$4\frac{3}{4}$	0	0
2	3	4	5	0	0
$2\frac{1}{8}$ - $\frac{1}{4}$	0	6	$5\frac{1}{2}$	0	0
$2\frac{1}{2}$	1	3	6	1	0
$2\frac{3}{4}$	0	1	$6\frac{1}{2}$	0	0
Total,	42	89	Total,	51	99

It will be seen by referring to Table III that fifty-one of the 150, or at least one-third, had abscess at the time hospital treatment was begun. By referring to the column marked "Shortening" one can see what relationship abscess bears to the different stages. For example, a suppuration may begin, and, indeed, did begin in thirteen instances, where there was no shortening and where the disease was presumably in the first stage. Indeed, it would seem that an abscess is still common in the early stage, and that a case once having reached the third stage of the disease is not apt to develop abscesses. It is not deemed of sufficient interest to designate the number of sinuses which appeared. Suffice it to say that the popular impression is not far from correct that when an abscess once forms others may be expected. This is abundantly borne out by statistics.

TABLE IV.  
ANGLES OF GREATEST EXTENSION,  
*In Cured Cases.*

At First Observation.		Final Examination.	
Angles.	No. of Cases.	Angles.	No. of Cases.
90-100 degrees . . . . .	2	90-100 degrees . . . . .	0
100-110 " . . . . .	5	100-110 " . . . . .	0
110-120 " . . . . .	5	110-120 " . . . . .	0
120-130 " . . . . .	5	120-130 " . . . . .	0
130-140 " . . . . .	21	130-140 " . . . . .	0
140-150 " . . . . .	19	140-150 " . . . . .	0
150-160 " . . . . .	12	150-160 " . . . . .	10
160-170 " . . . . .	27	160-170 " . . . . .	20
170-180 " . . . . .	3	170-180 " . . . . .	30
180 " . . . . .	8	180 " . . . . .	47
Total . . . . .	107	Total . . . . .	107

*In Cases still under Treatment.*

First Examination.		Final Examination.	
Angles.	No. of Cases.	Angles.	No. of Cases.
90-100 degrees . . . . .	3	90-100 degrees . . . . .	0
100-110 " . . . . .	3	100-110 " . . . . .	0
110-120 " . . . . .	2	110-120 " . . . . .	0
120-130 " . . . . .	3	120-130 " . . . . .	0
130-140 " . . . . .	2	130-140 " . . . . .	3
140-150 " . . . . .	2	140-150 " . . . . .	5
150-160 " . . . . .	3	150-160 " . . . . .	5
160-170 " . . . . .	0	160-170 " . . . . .	5
170-180 " . . . . .	5	170-180 " . . . . .	5
180 " . . . . .	2	180 " . . . . .	2
Total . . . . .	25	Total . . . . .	25

Table IV shows that the great majority when first coming under treatment presented a degree of deformity. In twenty-two instances there was an angle of 160 degrees, and, as it is difficult for two or three observers to measure with the same degree of accuracy, it may be safely assumed that thirty-nine were in the neighborhood of 160 degrees. A very common deformity is 140 degrees, and it is astonishing how well a child can walk with an angle of extension of 140. It is sometimes a question where this angle of extension seems to be pronounced, and where a small sinus or two complicates, whether it is not best to refrain from any attempts at correction by force. It would have been interesting to have noted the degree of adduction combined with flexion, but the angle of adduction in many cases was omitted. The practical bearing of this combination is the important question, whether attempts at correction are or are not necessary. Where adduction is a very prominent feature with very little flexion, then correction should be attempted. This is a good rule to follow, especially in the female sex. At the hospital it is usually regarded as important to admit patients who have even a moderate degree of adduction, combined with flexion. We feel that the results are worthy of note. Only six of the 107 cases present a deformity greater than 150 degrees, and it is satisfactory to note that forty-seven present no deformity whatever. Indeed, thirty might be added to this, which would give us seventy-seven, or more than half, where the deformity was scarcely appreciable, inasmuch as 170 degrees is not regarded of any moment in estimating the usefulness of a limb. Of the cases still under treatment, the deformity has been corrected in nearly all. A few (five or six) present a deformity ranging between 135 and 150 degrees. There are a certain number that have been advised readmission to the hospital, and, as above stated, all of these present a degree of adduction which makes this necessary.



TABLE V.  
SHORTENING IN INCHES.  
*In Cured Cases.*

At First Observation.		At Final Examination.	
Inches.	No. of Cases.	Inches.	No. of Cases.
None	35	None	21
$\frac{1}{8}$	11	$\frac{1}{8}$	7
$\frac{1}{2}$	12	$\frac{1}{2}$	12
$\frac{3}{4}$	5	$\frac{3}{4}$	7
1	6	1	24
$1\frac{1}{8}$	1	$1\frac{1}{8}$	4
$1\frac{1}{4}$	4	$1\frac{1}{4}$	6
$1\frac{1}{2}$	7	$1\frac{1}{2}$	3
$1\frac{3}{4}$	2	$1\frac{3}{4}$	2
2	4	2	7
$2\frac{1}{8}$	2	$2\frac{1}{8}$	3
$2\frac{1}{4}$	3	$2\frac{1}{4}$	2
$2\frac{1}{2}$	3	$2\frac{1}{2}$	2
$2\frac{3}{4}$	1	$2\frac{3}{4}$	1
3	4	3	1
$3\frac{1}{4}$	1	$3\frac{1}{4}$	0
$3\frac{1}{2}$	2	$3\frac{1}{2}$	3
$3\frac{3}{4}$	1	$3\frac{3}{4}$	0
4	1	4	1
$4\frac{1}{4}$	2	$4\frac{1}{4}$	0
		6	1
Total	107	Total	107

*In Cases still under Treatment.*

At First Observation.		At Final Examination.	
Inches.	No. of Cases.	Inches.	No. of Cases.
None	4	None	2
$\frac{1}{8}$	1	$\frac{1}{8}$	0
$\frac{1}{2}$	2	$\frac{1}{2}$	0
$\frac{3}{4}$	2	$\frac{3}{4}$	1
1	2	1	2
$1\frac{1}{8}$	0	$1\frac{1}{8}$	1
$1\frac{1}{4}$	0	$1\frac{1}{4}$	1
$1\frac{1}{2}$	2	$1\frac{1}{2}$	2
$1\frac{3}{4}$	0	$1\frac{3}{4}$	3
2	2	2	2
$2\frac{1}{8}$	0	$2\frac{1}{8}$	1
$2\frac{1}{4}$	1	$2\frac{1}{4}$	0
$2\frac{1}{2}$	1	$2\frac{1}{2}$	1
$2\frac{3}{4}$	0	$2\frac{3}{4}$	0
3	2	3	2
$3\frac{1}{4}$	0	$3\frac{1}{4}$	3
$3\frac{1}{2}$	1	$3\frac{1}{2}$	0
$3\frac{3}{4}$	2	$3\frac{3}{4}$	2
4	0	4	0
$4\frac{1}{2}$	2	$4\frac{1}{2}$	1
6	1	$6\frac{1}{2}$	1
	25		25

*In Cases advised Readmission for the Correction of Deformity.*

Inches.	At First Observation.	No. of Cases.	Final Examination.
None	. . . . .	3	See Table II.
$\frac{1}{4}$	. . . . .	0	
$\frac{1}{2}$	. . . . .	1	
$\frac{3}{4}$	. . . . .	1	
1	. . . . .	0	
$1\frac{1}{8}$	. . . . .	0	
$1\frac{1}{4}$	. . . . .	0	
$1\frac{1}{2}$	. . . . .	2	
$1\frac{3}{4}$	. . . . .	0	
2	. . . . .	0	
$2\frac{1}{8}$	. . . . .	0	
$2\frac{1}{4}$	. . . . .	0	
$2\frac{1}{2}$	. . . . .	0	
$2\frac{3}{4}$	. . . . .	0	
3	. . . . .	0	
$3\frac{1}{4}$	. . . . .	0	
$3\frac{1}{2}$	. . . . .	0	
$3\frac{3}{4}$	. . . . .	0	
4	. . . . .	0	
$4\frac{1}{2}$	. . . . .	0	
Total	. . . . .	7	

## DEATHS.

First Observation.  
See Table X.Final Examination.  
See Table X.

TABLE VI.

*Average Shortening in Inches.*

In cured cases, first observation . . . . .	1 inch.
In cured cases, final examination . . . . .	$1\frac{3}{8}$ inches.
In cases still under treatment, first observation . . . . .	2 inches.
In cases still under treatment, final examination . . . . .	$2\frac{1}{4}$ inches.
In cases advised readmission, first observation . . . . .	$\frac{9}{8}$ of an inch.
In cases advised readmission, final examination . . . . .	$1\frac{1}{2}$ inches.

It will be seen from Table V that thirty-five present no shortening whatever, and these were presumably in the first stage. At the final examination it was found that there were twenty-one who passed through the disease without any shortening. This we think is at least satisfactory. In one case there was a shortening of six inches. The average shortening when the cases were first seen, as well as when the disease was cured, is shown in Table VI. It is of the utmost importance to discriminate between real and apparent shortening; the former is due to a retardation in the growth of the affected limb or from destruction of bone in the joint,

and is independent of the amount of adduction or abduction, while the latter term may be applied to the inequality of the legs which results from the tilting of the pelvis.

In thirty-four of the cured cases the atrophy was a marked feature. This wasting of the limb, of course, is looked upon with favor in the early management of the disease, for the reason that one is better assured that the joint is satisfactorily protected if the reflex spasm is abolished and if the muscles are small and attenuated. Then there is not so much need for traction. After all, the atrophy is a sign of the severity of the disease. We regard a serious involvement of the head and neck as a necessary cause of atrophy. It is true, in many instances, that the muscles increase in size after the subsidence of the disease, yet this rule is not absolute. Efforts at restoring muscles by massage, electricity, and exercises are usually unsatisfactory. The best way to restore muscles to anything approaching their former size is by use of the limb.

In eleven cases we regret to note a recurvature of the knee. This ought to be prevented by the proper use of the apparatus. It is accounted for, however, in our cases by failure of the parents to report, by their lack of interest in the treatment, and by change of physicians. The parents sometimes feel that they can have the case treated by the family physician, or they themselves apply the adhesive plasters below the knee. Sometimes excoriations occur on the thigh and one fears a recurrence of this condition, so that the thigh is not included in the adhesive plasters in making traction. Under close observation this deformity can be prevented. It is a useful lesson, however, and we wish to emphasize it in passing. The rule should be never to make traction below the knee. The common device of putting a clove hitch about the ankle and hanging a weight over the foot of the bed is to be deprecated, because the employment of all force of this nature weakens the ligaments at the knee and gives a lax joint, which ends in recurvature or some other similar deformity.

TABLE VII.

*The Ultimate Results of Motion in Cured Cases.*

Perfect motion . . . . .	15
Good motion . . . . .	22
Limited motion . . . . .	41
Ankylosis . . . . .	9

The tables present, as will be seen, thirteen cases with perfect motion. Adding these fifteen to the twenty-two with good motion, there are thirty-seven of 107 that got well with a very fair range of motion. Only thirty-one of the number were without motion. The term "good motion" is employed to cover the variations in measurement. Different members of the staff from time to time recorded the ranges of motion, and, while there may have been differences of a few degrees, it was thought best not to specify the exact range.

A small range of motion is often highly satisfactory to the patient. It brings less strain upon the spinal column and enables him to sit more comfortably in a chair and present altogether a better appearance in society.

TABLE VIII.

TREATMENT: MECHANICAL AND OPERATIVE.  
*In Cases Cured.*

Method Employed.	Number of Cases.
Stretching and splint . . . . .	17
Plaster of Paris and splint . . . . .	14
Braces . . . . .	12
Aspiration, curetting, and splint . . . . .	9
Stretching, tenotomy, subtrochanteric osteotomy, and splint . . . . .	9
Stretching, subtrochanteric osteotomy, and splint . . . . .	7
Aspiration and splint . . . . .	6
Excision and splint . . . . .	4
Tenotomy, plaster of Paris, and splint . . . . .	4
Blisters . . . . .	4
Blisters and splint . . . . .	4
Aspiration, stretching, and splint . . . . .	4
Curetting, stretching, osteotomy, and splint . . . . .	3
Curetting and splint . . . . .	3
Curetting, tenotomy, and splint . . . . .	2
Stretching, tenotomy, and splint . . . . .	2
Stretching, curetting, and splint . . . . .	1
Aspiration, iodine, and splint . . . . .	1
Pulley and plaster of Paris . . . . .	1
Total . . . . .	107

*In Cases still under Treatment.*

Stretching and splint . . . . .	8
Splint . . . . .	4
Excision of abscess and splint . . . . .	3
Blisters and splint . . . . .	3
Poultices and splint . . . . .	1
Stretching, subtrochanteric osteotomy, and splint . . . . .	1
Stretching, curetting, and splint . . . . .	2
Aspiration, excision of abscess, and splint . . . . .	2
Aspiration, curetting, and splint . . . . .	1
Total . . . . .	25

*In Cases advised to Return for Correction of Deformity.*

Stretching and splint . . . . .	2
Brace . . . . .	1
Gants and splint . . . . .	1
Poultices and blisters . . . . .	1
Stretching, curetting, and splint . . . . .	1
Plaster of Paris and splint . . . . .	1
Total . . . . .	7

## DEATHS.

Aspiration, curetting, and splint . . . . .	4
Excision and splint . . . . .	2
Aspiration, plaster of Paris, and splint . . . . .	2
Stretching and splint . . . . .	2
Excision of abscess, curetting, and splint . . . . .	1
Total . . . . .	11

TABLE IX.  
*Cases of Femoral Osteotomy.*

Number of Cases.	Duration of Disease before Operation.	Angle of Deformity before Operation.	Shortening before Operation.	Angle of Deformity after Operation, Final Treatment.	Shortening after Operation, Final Treatment.	Length of Time from Operation until Last Measurement.	Remarks.
1	3 years, 9 months.	145	2 inches.	180	1 inch.	6 years, 2 months.	Hip ankylosed.
2	4 years.	100	2 inches.	140	1½ inches.	7½ years.	Hip ankylosed.
3	3 years, 1 month.	145	1¼ inches.	170	1 inch.	5 years, 8 months.	Slight adduction.
4	3 years.	130	None.	160	None.	7 years.	Five degrees motion.
5	5 years.	155	½ inch.	180	1 inch.	5 years.	No motion.
6	3½ years.	150	¾ inch.	160	None.	5½ years.	Five degrees motion.
7	5 years.	145	3 inches.	150	2½ inches.	5 years.	Uses cane.
8	5 years.	140	1 inch.	145	¼ inch.	5 years.	Uses crutch.
9	6 years.	150	2 inches.	140	1 inch.	6 years.	Marked limp.
10	5 years.	145	1¾ inches.	150	2 inches.	8 years.	Marked limp.
11	3½ years.	120	1¾ inches.	140	2 inches.	5 years.	Hip ankylosed.
12	10 years.	140	6 inches.	165	2¾ inches.	5½ years.	Hip ankylosed.
13	6 years.	140	1 inch.	180	None.	5 years.	Hip ankylosed.
14	10 years.	130	1¾ inches.	170	1 inch.	6½ years.	Hip ankylosed.
15	10 years.	110	1¼ inches.	180	None.	6½ years.	Hip ankylosed.
16	2 years.	90	¾ inch.	165	1 inch.	10 years.	Very slight motion.
17	2 years.	140	¾ inch.	150	¾ inch.	7 years.	Very slight motion.
18	12 years.	90	4¼ inches.	175	4 inches.	6 years.	Hip ankylosed.
19	5 years.	145	1 inch.	175	¾ inch.	5½ years.	Hip ankylosed.
20	1 year, 6 months.	130	None.	170	None.	8 years.	Some adduction.
21	1 year.	135	2 inches.	150	2 inches.	6 years.	At times wears a brace.

(TABLE IX CONTINUED, SHOWING THE FOLLOWING BY COMPARISON.)

<i>Amount of Shortening.</i>			
Before Operation.		After Operation.	
None	2	None	5
$\frac{1}{4}$	1	$\frac{1}{4}$	2
$\frac{1}{2}$	1	$\frac{3}{4}$	1
$\frac{3}{4}$	2	1	6
1	3	$1\frac{1}{2}$	1
$1\frac{1}{4}$	2	2	3
$1\frac{3}{4}$	3	$2\frac{1}{2}$	1
2	4	$2\frac{3}{4}$	1
3	1	4	1
$4\frac{1}{4}$	1		
6	1		
Total	21	Total	21

<i>Angle of Deformity.</i>			
Before Operation.		After Operation.	
90-100 degrees	2	90-100 degrees	0
100-110 "	1	100-110 "	0
110-120 "	1	110-120 "	0
120-130 "	1	120-130 "	0
130-140 "	4	130-140 "	0
140-150 "	9	140-150 "	4
150-160 "	3	150-160 "	3
160-170 "	0	160-170 "	4
170-180 "	0	170-180 "	10
Total	21	Total	21

Table IX shows the osteotomies and explains itself. The osteotomies are always supplemented by apparatus for a variable length of time,—from a few weeks to a few months. It has been a matter of common observation that even a bone, long after a union has taken place, will sometimes bend again, or at least the tissues about the hip will be contracted and give rise to a deformity which needs further correction.

It will be seen that twenty-one patients were submitted to this operation. This means that other methods failed to correct the deformity. We have been quite persistent in our efforts to correct by traction in bed with weight and pulley on incline plane, and time and again we have submitted patients to tenotomy, myotomy, and forcible stretching. Where all these fail, then we resort to femoral osteotomy.

Our experience leads us to dwell upon the necessity for maintenance of the good position gained by an osteotomy during a period of from six to twelve months. In cases where this precaution is not taken, relapses do occur.

Whether they occur because the disease is not fully arrested, we cannot say. The test of cure in an old case does not apply frequently, and we must be governed by the duration of the disease, by the condition of the patient, and by the long absence of pain. The osteotomy, therefore, is to be followed by the maintenance of a good position, whether one resorts to apparatus, plaster of Paris, or traction in bed.

TABLE X.  
DEATHS.  
*Condition at First Observation.*

No.	Acute.	Deformity.	Abscess.	Sinus.	Shortening.	Motion.
1	Yes.	135 degrees.	Yes.	Yes.	No.	No.
2	Yes.	R. 120 degrees.	Yes.	Yes.	No.	No.
3	Yes.	L. 110 degrees.	Yes.	Yes.	1 inch.	No.
4	Yes.	180 degrees.	Yes.	Yes.	1 inch.	Yes.
5	Yes.	170 degrees.	No.	No.	No.	No.
6	No.	{ R. 120 degrees. L. 130 degrees. }	No.	No.	2 inches.	Yes.
7	Yes.	115 degrees.	Yes.	Yes.	$\frac{3}{4}$ inch.	Yes.
8	Yes.	160 degrees.	No.	No.	$\frac{1}{2}$ inch.	No.
9	Yes.	None.	No.	No.	No.	No.
10	Yes.	150 degrees.	No.	Yes.	No.	No.
11	Yes.	110 degrees.	No.	Yes.	$\frac{1}{2}$ inch.	No.

*Condition at Final Examination.*

No.	Acute.	Deformity.	Shortening.	Abscess.	Sinus.	Cause of Death.
1	Yes.	170 deg.	None.	Yes.	Yes.	Amyloid degeneration.
2	Yes.	{ R. 130 deg. L. 145 deg. }	L. 1 inch.	Yes.	Yes.	Amyloid degeneration.
3	Yes.	160 deg.	1 inch.	No.	Yes.	Amyloid degeneration.
4	No.	160 deg.	3 inches.	No.	Yes.	Amyloid degeneration.
5	No.	165 deg.	1 inch.	Yes.	Yes.	Amyloid degeneration.
6	Yes.	{ R. 140 deg. L. 150 deg. }	2 inches.	Yes.	Yes.	Phthisis pulmonalis.
7	No.	175 deg.	1 inch.	No.	No.	Phthisis pulmonalis.
8	Yes.	160 deg.	None.	No.	No.	Phthisis pulmonalis.
9	Yes.	150 deg.	None.	No.	Yes.	Tuberculous meningitis.
10	No.	165 deg.	None.	No.	Yes.	Tuberculous meningitis.
11	No.	180 deg.	None.	No.	No.	Cardiac disease.

Of the cases that died, eleven in number, both joints were affected in two instances, and one of these had an abscess and sinus at the first examination, while the other did not. However, they developed this condition during the course of the disease, both hips being involved and the



suppurative condition continuing until the time of death, although it was noticeably greater in the one that died from amyloid degeneration than in the other, who developed secondary infection of the lungs. In the other four cases, where death was due to long-continued suppuration, all except one had an abscess and sinus when first seen, but latterly only two had abscesses, while four still had sinuses. All were very acute on admission, and three were found to be so at the final examination. In these same cases the angle of greatest extension in one was 170 degrees at the time of death, in one 165 degrees, in two 160 degrees, and in one 130 degrees on the right side and 145 degrees on the left. One had no shortening, three one inch, and one three inches shortening. One case lived twelve years after the onset of the disease, two between six and six and a half years, one eight years, and one seven years. Where the cause of death was due to phthisis pulmonalis, as it was in three cases, two were acute at the first examination, only one had an abscess and sinus, and one no motion or shortening, and a difference in the comparative lengths of the legs of two inches in one, and three-quarters of an inch in the other, while the angle of greatest extension of one was 160 degrees, the other 115 degrees, and where it occurred on both sides the right was 120 and the left 130 degrees. The final examination record in each case, less than a year before death, states that two were acute, one had one inch shortening, the other two inches, and in the third there was no difference. Two had abscess at the time of death, while all three had sinuses, and the angles of greatest extension were 160, 170, and in one case where it occurred on both sides, the right was 140 and the left 150 degrees. Two cases lived five years and one seven years before developing pulmonary disease. In one of this series the predisposition to affection of the lungs might have been anticipated, for both the father and mother died of the same affection shortly before their child. Tuberculous meningitis claimed two cases, neither having shortening, motion, or abscess when first examined, but were markedly acute. One had a sinus and one

no deformity, while the other had an angle of greatest extension of 150 degrees. At the final examination one was still very acute, and had one inch shortening, while both had sinuses and limited motion, but no abscesses, and the angles of greatest extension were 150 and 165 degrees respectively. The meningitis did not manifest itself until the joint-disease had extended over five years in one instance and six years in the other. One case, with incurable disease of the heart, was doing very well, although the brace had not been removed because the joint was still in an acute condition at the time of death, so it was included in this series. A letter received from the attending physician stated the cause to be mitral and aortic stenosis. One patient who had amyloid disease, lingering between life and death for a year, became equally discouraged with its parents in seeing no improvement, and all three committed suicide.

Death did not appear to be dependent upon operative procedures, for only in two cases of the series was a radical operation performed, and the patient did not die until five years later, in the mean time developing many abscesses.

TABLE XI.

*Average: On basis of one hundred and fifty cases.*

	Percentages.
Males . . . . .	47 $\frac{1}{3}$
Females . . . . .	52
Right side . . . . .	53 $\frac{1}{3}$
Left side . . . . .	43 $\frac{1}{3}$
Both sides . . . . .	3 $\frac{1}{3}$
Had some treatment before admission to hospital . . . .	72 $\frac{1}{2}$
Had no treatment before admission to hospital . . . .	27 $\frac{1}{3}$
Entirely cured . . . . .	71 $\frac{1}{3}$
Still under treatment . . . . .	16 $\frac{2}{3}$
Correction of deformity advised . . . . .	4 $\frac{2}{3}$
Deaths . . . . .	7 $\frac{1}{3}$
Subtrochanteric osteotomy . . . . .	14

*Cured Cases. (107.)*

	Percentages.
Acute at first observation . . . . .	83
Abscess at first observation . . . . .	37 $\frac{1}{3}$
Sinus at first observation . . . . .	19 $\frac{2}{3}$
Had some angular deformity at first observation . . . .	92 $\frac{1}{2}$

	Percentages.
Had no shortening at first observation . . . . .	32 $\frac{3}{4}$
Had some motion at first observation . . . . .	82 $\frac{1}{4}$
Had no deformity at final examination . . . . .	44
Had no shortening at final examination . . . . .	19 $\frac{1}{2}$
Had perfect motion at final examination . . . . .	12
Had good motion at final examination . . . . .	20 $\frac{1}{2}$
Had limited motion at final examination . . . . .	37 $\frac{1}{2}$
Had ankylosis at final examination . . . . .	29

*Cases still under Treatment. (25.)*

Acute at first observation . . . . .	76 per cent.
Abscess at first observation . . . . .	44 "
Sinus at first observation . . . . .	8 "
Had some angular deformity at first observation . . . . .	92 "
Had no shortening at first observation . . . . .	16 "
Had some motion at first observation . . . . .	84 "
Had no deformity at final examination . . . . .	8 "
Had no shortening at final examination . . . . .	8 "
Perfect motion at final examination . . . . .	4 "
Good motion at final examination . . . . .	24 "
Limited motion at final examination . . . . .	56 "
Ankylosis at final examination . . . . .	16 "

TABLE XII.

*Showing Time elapsed since Cases left Hospital.  
Cured Cases. (107.)*

Years:	5-7	7-9	9-11	11-13	13-15	15-17	17-19	20.	
No. of cases:	42	26	20	8	6	3	1	1	Total 107.

*Still under Treatment. (25.)*

Years:	5-7	7-9	9-11	11-13	13-15	15-17	17-19	20.	
No. of cases:	14	5	3	2	0	1	0	0	Total 25.
Same in cases advised readmission (see Table II).									
Deaths (see Table X).									

The following deductions may be made:

(1) Hygienic and constitutional measures exert a powerful influence in the control of the disease.

(2) The early diagnosis of hip-joint disease represents a very important factor in attaining a successful ultimate result.

(3) During the acute stage, rest in bed, associated with the usual mechanical appliances, is preferable to ambulatory treatment.

(4) In the first stage it is essential to procure absolute immobilization by fixation and traction (extension), and also to furnish protection to the joint.

(5) In the second stage the deformity must be corrected, and operative procedures resorted to if mechanical methods fail after a reasonable length of time,—usually six months.

(6) Early correction of the deformity is advised, using as little force as is consistent with the individual case.

(7) Adduction with flexion is the deformity which most frequently calls for correction.

(8) Flexion without adduction rarely requires correction.

(9) *Forcible correction*, followed by fixation, should be tried before attempting reposition by femoral osteotomy.

(10) Where there is absolute ankylosis or only a few degrees of motion, and all manifestations incident to an acute condition have subsided, the operation of subtrochanteric osteotomy for the correction of the deformity is indicated, supplemented, if necessary, by tenotomy, myotomy, and fasciotomy.

(11) The injection of various chemical substances into abscesses and sinuses has not proved beneficial.

(12) When an abscess does not disappear after repeated aspirations, radical operative procedures are clearly indicated, to be followed, if necessary, by resection of the joint.

(13) When the disease is complicated by pus-formation in young children, more especially in the first years of life, there is less need of fearing a poor result than in adults, as the former frequently recover with a movable joint, a condition which may be explained by the fact that the head of the bone at this time is cartilaginous.

(14) Long-standing and profuse suppuration retards the process of reparation and gives rise to a grave prognosis; furthermore, the absorption of pus is associated with great danger and frequently results in acute septicæmia and amyloid degeneration.

(15) Treatment should be continued not only during the acute and subacute stages, but also during the convalescent period.

## THE USE OF EGG-MEMBRANE IN TREPHINING OPERATIONS UPON THE SKULL.

By LEONARD FREEMAN, M.D.,

OF DENVER,

PROFESSOR OF SURGERY IN GROSS MEDICAL COLLEGE; SURGEON TO THE ARAPAHOE  
COUNTY HOSPITAL AND ST. ANTHONY'S HOSPITAL.

RECENT improvements in operative technique and in methods of diagnosis have given a marked impetus to surgery of the brain, but in some directions there is considerable yet to be desired. The beneficial results, for instance, of the most brilliant operations may be destroyed by the formation of adhesions between the brain and its coverings and the scalp. In the endeavor to prevent this a number of devices have been employed. W. W. Keen has suggested the inversion into the trephine opening of a pedunculated flap of periosteum obtained from the adjacent surface of the skull. The manœuvre, although ingenious, is troublesome and not altogether satisfactory. It has not been extensively adopted.

The most popular method consists in the introduction of some foreign substance, such as gold foil (Beach) or rubber tissue (Abbe); but observation has demonstrated that both of these materials may become surrounded by connective tissue, which gives rise to more extensive adhesions than would otherwise have occurred. I possess a specimen of foil which I placed in a trephine-opening in the posterior fossa during the course of an operation for cerebellar tumor. The patient lived about three months, and in that time considerable new connective tissue had formed.

Even the heavier varieties of foil are apt to crack and break into smaller pieces, as occurred in the specimen above

mentioned. Rubber tissue also becomes disintegrated. Surrounding a piece of rubber which he had employed, McCosh found at the autopsy, some time later, a large cicatricial mass, which had given rise to decided clinical symptoms.

Furthermore, a foreign body, be it gold, rubber, or what not, is liable at any time to cause suppuration, which will necessitate its removal, even though the wound may originally have healed by first intention. I recently observed two such cases at the County Hospital in Denver.

Some time since the writer conceived the idea that the lining membrane of an egg would present advantages in the prevention of adhesions following operations upon the brain. This membrane is exceedingly compact and tough, in spite of its thinness. It is so remarkably durable that it has been employed to close perforations in the tympanum, where it often remains intact for months. It was assumed without question that the contents of a fresh egg would be sufficiently aseptic.

In order to test the efficiency of the method, some experiments were undertaken. In this connection I desire to acknowledge the assistance of Dr. A. H. Williams.

*Experiment I.*—A newly laid hen's egg was scrubbed and sterilized in bichloride of mercury. The shell was cracked and peeled from the underlying membrane over a sufficiently large area. A trephine-opening was made in the skull of a dog, the membranes cut away, and the surface of the brain lacerated. A portion of egg-membrane was removed with sharp-pointed scissors, and inserted in the opening, the scalp being closed above it. Infection took place at the end of about a week, owing to the dog scratching off the dressing and tearing open the wound. Considerable suppuration resulted.

Five weeks after the operation the animal was killed, when autopsy revealed that the egg-membrane had remained intact, in spite of the length of time during which it had remained in the centre of a focus of active suppuration.

*Experiment II.*—An operation similar to the one just described was performed upon a large, black rabbit. There was

no disturbance in the healing of the wound. The animal was killed and the parts carefully examined at the end of two months. There were absolutely no adhesions of the scalp, even the deep fascia being fully movable over the trephine-opening. The brain, which presented a yellowish nodule at the point where it had been freely lacerated, was smooth and non-adherent, except by a few trivial and extremely delicate adhesions around the edge of what had been the opening in the dura. The hole in the skull was filled by a thin, smooth membrane, half of which was transparent and half yellowish-opaque, and somewhat thicker than the remainder. This latter portion represented what was left of the egg-membrane. There was no deposit of cicatricial tissue anywhere about the site of the operation. Microscopic sections, prepared by Dr. E. R. Axtell, of Denver, showed that the egg-membrane had apparently been replaced by a layer of adipose tissue, permeated here and there by blood-vessels. Beneath this was a delicate layer of connective tissue, containing a moderate number of small, round cells, which filled the trephine-opening.

In view of the above considerations and experiments, the writer feels justified in claiming the following advantages for the use of egg-membrane in cerebral surgery:

(1) That it is inexpensive and can be easily obtained where such substances as gold foil are not at hand.

(2) It is not in the full sense of the term a "foreign body," but seems in a measure to incorporate itself with surrounding tissues without causing perceptible irritation or the formation of noticeable cicatricial deposits. Even though it ultimately becomes absorbed, it remains intact sufficiently long to accomplish the purpose for which it was inserted.

(3) There is no danger of subsequent infection requiring a second operation and leading to extensive formation of connective tissue.

## THE TREATMENT OF FRACTURES OF THE NOSE.<sup>1</sup>

By GWILYM G. DAVIS, M.D., M.R.C.S. (ENG.),

OF PHILADELPHIA,

SURGEON TO THE EPISCOPAL, ST. JOSEPH'S, AND ORTHOPÆDIC HOSPITALS.

THE subject of fractures of the nose is hardly treated in our text-books with such clearness of description as to the character of this injury and its treatment as to enable those not quite familiar with it to decide what course to pursue in the individual case.

Nasal surgery has made such advances of recent years that to do good general surgery one should possess also some of the resources of the specialist. The extent of an injury to the nose is to be discovered by both an external and internal examination. Externally it is to be noted whether the normal outline is preserved. There is frequently a deviation to one side or an obvious depression. The surface should be carefully felt with the finger-tip, as by so doing inequalities which are hidden by swelling may be detected. Lateral movement will usually elicit crepitus. Internally, examination may be obstructed by swelling and clotted blood. The latter is to be carefully washed away by gentle syringing or wiped away with cotton on a cotton-carrier; if bleeding continues, perhaps the use of ice-water or alum or cocaine solution will check it; it is seldom necessary to use packing. Iron salts make too nasty a clot to be recommended, besides being irritating. The use of a head-mirror and speculum is necessary; the largest size oval-shaped ear-speculum is best. Before attempting any extensive manipulation on the inside of the nose, it is desirable to deaden its sensibility; this may be accomplished by wetting a pledget of absorbent

<sup>1</sup> Read before the Philadelphia Academy of Surgery, June 6, 1898.



cotton with a 2- or 4-per-cent. solution of cocaine and introducing it. Cocaine-poisoning can occur. I once had a patient, a strong laborer, who, as soon as the pledget was introduced, became deathly pale and faint, and was only restored after being given a liberal amount of ammonia and whiskey, and allowed to lie down for a quarter of an hour. A 4-per-cent. solution of cocaine was used in this case. The use of cocaine in this manner also tends to reduce swelling and



Anchoring a laterally displaced nose by means of a strip of gauze and collodion.

stop any hæmorrhage. Its hæmostatic effect is increased by the addition of 5 per cent. of antipyrin. Instead of examining the patient while sitting he may be placed in the "Rose" position, lying flat on his back, with the head hanging over the edge of the table. The external injury, if marked, consists of a displacement of the bones either antero-posteriorly—that is, the nose is crushed in—or laterally. If the injury has not been so severe, there may be no displacement or only a slight one. The fragments are sometimes loose and some-

times tight. If the latter is the case, a general anæsthetic (ether) may be given, if thought desirable, while replacement is being attempted. When the bridge has been depressed its elevation may be attempted by introducing a flat steel director (Sir Astley Cooper's), or best by using the flat bill forceps of Adams. To retain it in position, L. D. Mason (*Annals of Anatomy and Surgery*, Vol. ii, p. 107; Vol. iii, p. 81) thrust a pin from side to side through the nose and placed a strip of plaster over from one of its ends to the other. Perhaps a preferable way is to put a piece of cork on each projecting end of the pin and pushing them together until the bridge is sufficiently elevated. The bony deformity in fractures of the nose does not tend to disappear, so that, if it is desired to remedy it, it should be done at once.

To correct lateral deformity, it is often sufficient to simply press the parts back with the fingers. In obstinate cases I have been successful by taking hold of the nose by means of a wet towel. This prevents the fingers from slipping, and gives one a wonderful control over the organ. By pulling directly outward, the fragments can be unlocked and then readily replaced laterally. Success is recognized by the disappearance of the deformity. To correct lateral displacement shields made of lead or gutta-percha have been used; I have not had much experience with them. Adams devised two lateral pads fastened to a head-band and adjusted by a screw. Gamgee ("Treatise on Wounds and Fractures," p. 348) had an apparatus which pressed on one side of the nose by means of a screw and spring.

Quite recently a similar apparatus has been described by Frederick C. Cobb (*Journal of the American Medical Association*, March 12, 1898, p. 588). The difference between them is that Gamgee prevented lateral movement of the apparatus by means of a spectacle frame, while Cobb does so by having a stiff metal head-band fitted carefully to the circumference of the head. I have successfully accomplished the same object by taking a strip of gauze and fixing one end to the side of the nose by means of collodion; the opposite cheek is then drawn forward and the other end of the gauze is to be

fastened to it by the same means. Thus the nose can be drawn towards the side desired and lateral displacement remedied. It may be noted that the gauze is fastened on its bony portion and not only to its cartilaginous tip. The dressing should be examined, and, if necessary, renewed every other day, so that a constant tension is maintained. These fractures heal very rapidly, so that the dressing may be dispensed with in from three to seven days.

Plastering the nose with sticking plaster serves no useful object, the use of collodion and cotton is better. Deviation of the cartilaginous or bony septum can be determined by ocular inspection or by the gentle introduction of a not-too-large little finger. Intranasal pressure, best exerted by the finger, is more efficacious in pushing and keeping the septum to one side than it is in raising a depressed bridge. Plugging of the nose is disagreeable under any circumstances, and in some intolerable. The use of pins is preferable. They should preferably have a spear point and a flat head lengthwise with the shaft. This head is to be covered with a piece of soft, thin, rubber tubing. They should be introduced while sensation is dulled with local or general anæsthesia and left in place several days. If plugging is resorted to plain cotton is preferable to absorbent cotton, as it contains a small quantity of oil. Inasmuch as the septum is bent towards one side or the other, and not both, it is neither necessary nor desirable to plug both nares; plug only the one towards which the septum is bent. Sometimes plugging the upper portion of the nares only will suffice, leaving a passage on the floor of the nose free for a current of air. The use of hard-rubber tubes to keep the nostrils open and the septum in place may cause excessive pain, and will not be tolerated if there is any pressure exerted by them. A far more comfortable plan is to introduce a piece of soft-rubber drainage-tube. This is very liable to come out, and if it does, the patient should be instructed to replace it. It is better, however, to rely on pins to keep the septum straight. Dobell's solution, or one made with Seiler's tablets, should be used frequently to spray and cleanse the interior of the nose.

## SEPARATION OF THE UPPER EPIPHYSIS OF THE HUMERUS.<sup>1</sup>

By HENRY R. WHARTON, M.D.,

OF PHILADELPHIA.

THIS accident may occur at any period of life from birth up to the twentieth year, and consists in a separation of the upper epiphysis of the humerus, comprising the head and tuberosities, from the diaphysis, and does not open the shoulder-joint; the line of separation being the line of the epiphysis, which begins at the axillary margin of the head of the bone and runs across it, slightly rising towards the centre in a direction almost horizontal, and ends at the outer side just below the position of the tuberosities, the line of separation in this injury closely approximating that observed in fracture of the anatomical neck of the humerus.

R. W. Smith ("Fractures and Dislocations," 1847), in describing this injury, says that the head of the bone can be felt in the glenoid cavity, and remains motionless when the shaft of the bone is rotated. The deformity is usually marked, and consists of a distinct prominence below the coracoid process, caused by the upper extremity of the lower fragment projecting in front of the shoulder-joint, and also the fragment being drawn inward and forward by the muscles passing from the chest to the humerus. Shortening is usually not marked, from the fact that the two surfaces are extensive, and are not entirely separated from each other.

It has been pointed out by Moore that the separated surfaces may preserve their normal relations to each other, and little deformity occur. This, in my experience, is un-

<sup>1</sup> Read before the Philadelphia Academy of Surgery, May 2, 1898.

usual, and I think is most likely to be the case in very young subjects.

Moore has observed that the displacement is not usually complete, but that the upper end of the lower fragment is carried inward to a distance of about one-quarter of its diameter, when it is arrested by the convexity of the lower fragment becoming lodged in the natural concavity in the upper fragment, caused by the epiphyseal line; the upper fragment now becomes tilted by the action of the muscles, its internal margin ascending into the glenoid cavity, and its outer margin descending until it is arrested by the capsule.

This accident is most likely to be confounded with dislocation of the shoulder, but a mistake is not likely to occur if one observes that the shoulder-joint is not rigid, and that the arm hangs close to the side, and that the elbow is directed slightly backward and outward, and that there is a marked prominence of an inch and a half below and anterior to the acromion process. It should also be remembered that dislocation of the shoulder in children is an extremely rare accident. By manipulation crepitus can also often be obtained.

The reduction of the deformity, although it is considered by Moore not to be difficult, is, I think, usually a matter of the greatest difficulty. I have attempted it under ether without marked success, and where I have been able to bring about its reduction, it has often reappeared after the reducing force was withdrawn. R. W. Smith states that there is no fracture of the upper extremity in which it is more difficult to retain the fragments in their relative positions. Moore, in bringing about reduction, recommends that the arm be carried forward and upward in a perpendicular line; the upper fragment, or epiphysis, will remain fixed, being held fast by the capsule inserted into the outer and posterior margins of the head of the bone, while the lower fragment, or diaphysis, aided by the natural action of the muscles, will move outward and resume its original position. I am free to confess that, although I have seen the deformity diminish under this manipulation, I have not been able to completely

reduce it to my satisfaction in cases where the deformity was marked before the manipulations were attempted.

In spite of the fact that it is often impossible to bring about complete reduction of the deformity, the results of treatment are usually most satisfactory as regards the functional result. The treatment which is generally recommended, and which I have adopted in cases coming under my own observation, consists in attempting by manipulation to restore the fragments as nearly as possible to their normal position. The dressing, then, consists in applying a primary roller to the forearm and arm, from the tips of the fingers to



FIG. 1.—Deformity in separation of the upper epiphysis of the right humerus.

the axilla. A wedge-shaped pad of oakum or lint is next placed between the arm and the chest, with its base in the axilla. A shoulder-cap of binders' board is next moulded to the shoulder and outer surface of the arm, extending to a point a short distance above the condyles; this is padded and applied to the arm and shoulder, and secured by a bandage. The arm is next brought firmly against the side of the chest, and secured by circular turns of a bandage. The forearm is then supported in a sling, in which the forearm rests at the wrist. The dressing is practically that known as Ferguson's for fractures of the upper extremity of the humerus. The

dressings is changed at intervals of two or three days, and all dressing is usually dispensed with at the end of the third or fourth week, passive motion not being made until this time.

The functional result following this injury, as before stated, is usually very good, but it sometimes happens that non-union occurs, causing an unfavorable result, as in a case reported by Hamilton, and also that occasionally osteomye-



FIG. 2.—Separation of the upper epiphysis of the humerus.

litis may follow the injury, as in a case recorded by Esmarch, in which excision of the joint was resorted to.

Arrest of growth of the limb in length has also been pointed out as a possible result of epiphyseal separation from injury, and premature ossification of the cartilage of conjunction. Although this is a possible sequel of the injury, I do

not think that it is a very common one, for the cases which I have had under observation for several years show no difference in the length of the limbs on each side. I desire to place on record the following four cases of this injury:

CASE I.—C. McC., aged sixteen years, in the month of March, 1896, fell from the roof of a porch, about fourteen feet in height, striking upon the right shoulder. Upon examination, I found he had sustained a separation of the upper epiphysis of the right humerus. A photograph, taken shortly after the accident (Fig. 1), shows the characteristic deformity of this in-



FIG. 3.—Skiagraph of case shown in Fig. 2, one year after the injury.

jury, and a skiagraph taken at the same time (Fig. 2) shows the position of the fragments. The patient recovered with a good functional result, and a skiagraph taken a year after the accident (Fig. 3) shows that the space between the fragments has been filled up by callus. Motion at the shoulder-joint at this time being almost perfect.

CASE II.—J. B., a boy, aged ten years, during July, 1897, fell from a fence six feet in height, and struck upon his left shoulder, sustaining a separation of the upper epiphysis of the humerus. A skiagraph (Fig. 4), taken immediately after the



accident, shows the typical deformity. This patient recovered with little deformity, and complete motion at the shoulder-joint.

CASE III.—E. C., aged nine years, received, in September, 1897, a fall, striking upon the right shoulder, and, on examination, I found she had sustained a separation of the upper epiphysis of the humerus. This patient recovered with a very useful arm.

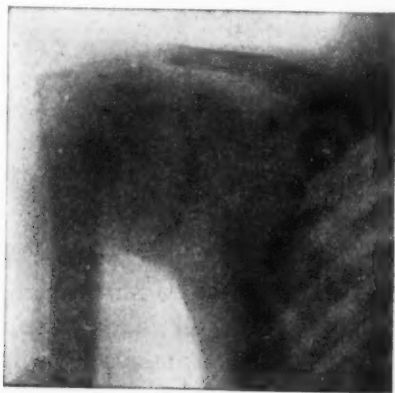


FIG. 4.—Skiagraph of separation of the upper epiphysis of the humerus.

CASE IV.—E. M., aged thirteen years, while playing football received a fall, striking upon the right shoulder. Examination showed the characteristic deformity of separation of the upper epiphysis of the humerus; a skiagraph, taken a short time afterwards, confirmed the diagnosis. This patient also recovered with almost complete function of the shoulder-joint.

REMARKS ON THE TREATMENT OF TUBERCULOSIS OF THE UTERUS AND FALLOPIAN TUBES.<sup>1</sup>

By WILLIAM WOOD RUSSELL, M.D.,

OF BALTIMORE,

ASSOCIATE IN GYNÆCOLOGY, JOHNS HOPKINS UNIVERSITY AND HOSPITAL.

J. W. WILLIAMS (*Johns Hopkins Hospital Reports*, Vol. iii, 1893), whose admirable monograph on "Tuberculosis of the Female Genitalia" aroused so much interest in this subject, claims that 8 per cent. of all Fallopian tubes removed for inflammatory disease are tuberculous in origin. When we consider how frequently inflammatory conditions of the tubes are found, the subject assumes a great importance.

It is my purpose to present briefly some of the aspects of tuberculosis of the tubes and uterus from the operator's stand-point in the light of what we have found in the laboratory and the operating room.

Since the introduction of hysterio-salpingo-oöphorectomy as an operative method of treating inflammatory diseases of these organs, we have been able to study, in a certain number of cases, the relation of tuberculosis of the tubes to the uterus. For practical purposes the operator can divide tubercular salpingitis into two forms, according to the position of the disease.

First, the form in which the disease is found on the peritoneal covering of the tube in association with primary tuberculosis of the peritoneum.

Second, where the disease originates in the tube and the peritoneum is exempt or but slightly affected.

<sup>1</sup> Read before the annual meeting of the Medico-Chirurgical Faculty of Maryland, April 26, 1898.

It has not been our custom to remove the tubes or uterus in the first form, therefore I am not able to speak of their relative condition.

In twelve cases of the second form, which we have studied in the laboratory, there existed coincident tuberculosis of the endometrium and tubes, with the exception of two, and in these two a chronic salpingitis was present.

In three instances we have diagnosed tuberculosis of the endometrium from curettings, and upon removing the uterus and tubes discovered that the tubes were likewise tuberculous. Also in two cases of tubercular endosalpingitis, found during operation, curettings from the uterus revealed a tuberculosis there. One is therefore justified in assuming in practically every case of tubercular endosalpingitis that the uterus is also tuberculous. On the other hand, if curettings from the uterus show a tubercular endometritis, it would strongly indicate an involvement of the tubes. These points are particularly valuable to the operator, as in no class of inflammatory cases is the question more puzzling, how much or how little to do. Under strict surgical principles the one answer is, if the disease is limited to these organs, that it should be looked upon as a malignant growth demanding removal of all the affected tissue.

One must consider before undertaking the radical operation the patient's general condition, and exclude tubercular deposits in other parts of the body. If such deposits were found, an operation would probably be futile. The only exception being a mild tubercular process of the peritoneum. Such being found during operation, one would not hesitate to adopt radical treatment.

It is not my purpose to discuss the successful treatment by coeliotomy or drainage of tubercular peritonitis with secondary tubercular salpingitis, but I would condemn removing the tubes or uterus in these cases, believing it to be absolutely unnecessary, in view of the long series of successful cases in which these organs were not disturbed. In a certain number of these cases the tubes are filled with cheesy material, which is constantly being discharged through a gaping

fimbriated extremity; a condition which would warrant their removal.

Hegar ("Die Entstehung, Diagnose und chirurgische Behandlung der Genital-Tuberculose des Weibes," Stuttgart, 1886) advocated in cases where the tubes and uterus were involved supravaginal amputation of the uterus. I would condemn this suggestion as I would supravaginal amputation of the cervix in cases of carcinoma of the uterine body or vaginal amputation in cancer of the cervix. The principle is the same in both; we are not justified in assuming that the disease is confined to any particular area, and are therefore compelled to remove the whole of the organ in question.

Cullen (*Johns Hopkins Hospital Reports*, Vol. iv), who calls attention to this point, says it would be advisable to remove the uterus at the same time as the tubes. I would go even further, and claim that such a procedure is demanded.

The choice between the vaginal and the abdominal route of removing the uterus and their tubes brings up a question exciting considerable discussion at present among gynæcologists. In these cases particularly would the abdominal method, I believe, give the best opportunity for an entirely successful result. It is very essential to avoid mutilating the organs during removal, thereby escaping the dangers of infection from the tubercle bacilli or leaving portions of diseased tissue in the pelvis.

Adhesions about the tubes are nearly always present, and during the progress of vaginal hysterectomy are very liable to be ruptured, allowing the escape of tuberculous material, or torn and pieces left behind. While, on the other hand, by the abdominal operation a careful dissection can be made and the pelvis cleared of infected tissue or the tubes, which are frequently sealed by the inflammatory process, can be removed intact.

In cases where the diagnosis of tubercular endometritis is made from curettings it is advisable to pack the uterus with gauze, and then close the cavity by suturing the lips of the cervix together; in this way the field of operation is kept from contamination during the enucleation.

Even if, after opening the abdomen, one finds unexpectedly tubercular disease of the tubes and a radical operation is proposed, it would be safer to pack the uterus and close the cervix before proceeding.

Werder (*American Journal of Obstetrics and Gynecology*, Vol. xxxvii, No. 3, 1898), of Pittsburg, has recently described a new technique to be employed in abdominal hysterectomy for cancer, which, in cases of tuberculosis of the uterus and tubes amenable to operative treatment, where the vagina is involved, would be a most useful adjunct. He first severs the tubes, ovaries, and uterus through an abdominal incision, and then dissects the vagina from all attachments even down to the orifice, if necessary. After which he forces the uterus and appendages with the detached vagina in prolapsus, and then brings together the peritoneal edges, entirely closing off the abdominal cavity. The operation is afterwards completed by the vaginal route, and as much of the vagina is removed as necessary without difficulty. This method would also afford a complete protection against the dangers of infection of the peritoneum.

In all hysterectomies during the past three years, whenever feasible, we have left the ovaries or parts of them with the result that the patients complain much less of the distressing symptoms of the artificial menopause. The same plan may be followed in dealing with this disease, and fortunately the ovaries are but rarely the seat of tuberculosis.

It may be claimed that we are in but a small per cent. of cases able to recognize the disease before or at the operation, and are therefore not in a position to decide upon a radical operation. This, to a certain extent, is true, as Williams states that in our cases of salpingitis, upon which his work is based, a diagnosis in only  $1\frac{1}{2}$  per cent. of them had been made. With experience in the operating and more care in the subsequent study of specimens, as I have already mentioned, this percentage will be greatly increased. If any doubt exists it would be better to give the patient the benefit, and extirpate both the uterus and tubes.

## HOW TO PREVENT THE DANGERS AND DISAGREEABLE SYMPTOMS OF ETHER.<sup>1</sup>

BY JOHN D. RUSHMORE, M.D.,

OF BROOKLYN,

PROFESSOR OF SURGERY, LONG ISLAND COLLEGE HOSPITAL.

It is not proposed in this paper to discuss the relative merits of different anæsthetics, old or new; nor to occupy time with the consideration of the history of anæsthesia, but to present the results of my experience in preventing the dangers and disagreeable symptoms that occur during and after the administration of ether. If the same painstaking efforts had been expended during the last quarter of a century in discovering and employing means to overcome the objections to ether as have been spent in improving methods of wound treatment, we should now have as satisfactory experience with ether as we have in our wound healing. No apology, perhaps, therefore is necessary for presenting a paper to the society on so worn a subject as ether anæsthesia, even though it be elementary; for our success with ether as in wound treatment will depend on our knowledge of elementary things and the care that we take in details.

It cannot be denied that the administration of ether is accompanied and followed by certain dangers and disagreeable symptoms; but in view of our improved methods of using it, it may be fairly asked, when unpleasant or dangerous symptoms arise, to what extent the ether is responsible for their development, to what extent the etherizer and to what extent the patient, by an unusual susceptibility, may be held responsible for ill effects. While, in a sense, the ether is always at fault, because the symptoms develop under its in-

<sup>1</sup> Read before the New York Surgical Society, April 11, 1898.

fluence, my experience leads me to feel that the preparation of the patient and, still more, the method of administering the ether have very much more to do with the presence of these symptoms than the ether. However, this question cannot be answered finally until careful observation over a somewhat prolonged period, and of a sufficient number of cases, shall have furnished a basis of comparison between the older and newer methods of administration. Children and drunkards constitute an apparently exceptional class, but not really so; for in the first instance, owing to a nervous dread, and in the second to a physical change induced by the prolonged use of alcohol, we cannot administer the ether in the manner we desire. These conditions, however, do not contraindicate the use of ether.

With regard to the preparation of the patient, I think too much importance cannot be attached to the use of morphia and atropia. Six minims of Magendie's solution with one one-hundred-and-twentieth grain of sulphate of atropia is almost always prescribed, and given, hypodermically, not less than half an hour nor more than one hour before the ether is to be used. In children the morphia is sometimes omitted, or this combination, or another opiate, with the atropia given by the stomach. I have not noticed that there was any difference in effect except a slower influence by stomach administration. The reason for omitting the opiate in young children is their susceptibility to the drug, and the reason for using the atropia in adult dose is their tolerance of belladonna. I learned the value of morphia many years ago from a patient who was suffering pain after an operation, and who asked me, after I had given him a hypodermic of morphia, why I had not given it to him before the operation. Its use at that time has these prominent advantages: it quiets the patient's nervous system, rendering him more susceptible to the ether; he needs less ether to anæsthetize him, also, during the operation; he comes out from under its influence more quietly, often sleeping for an hour or more; it lessens instead of increases the disposition

to nausea, and it forestalls the pain that the patient might otherwise suffer, and renders him more tolerant of the pain that he actually has to bear. I know of no objection to its use, except the dryness of the pharynx that it produces, and that I have not been able to overcome. The advantages of the atropia are, first and most important, the control that exercises over the bronchial secretion as well as that of the larynx and pharynx, rendering the patient's respiration free and easy throughout the operation, if the ether is properly administered; but it must be admitted that, when the ether is given in too large quantity, the atropia will fail in a measure to prevent the accumulation of mucus that is so objectionable. The patient will also, as a rule, come out from under the influence of the ether with a dry skin. The atropia has, besides, a marked action as a heart stimulant, and may in one or more of these ways lessen or prevent the shock of the operation, as some claim. I think it lessens the danger of suppression of urine by its diuretic action. It has the same objection as morphia, even in a more marked degree, of drying the pharynx. If ether anæsthesia is made more comfortable by the use of atropia, the objectionable features of atropia are, on the contrary, lessened by ether, as is illustrated in a case of a child, seven years of age, on whom I operated several years since. The boy had administered to him hypodermically one-half grain instead of one one-hundred-and-twentieth grain of atropia sulphate a half hour prior to the use of ether. One hour after the operation he developed marked symptoms of belladonna-poisoning, which passed away within a few hours, except the dilatation of the pupil and the paresis of accommodation. I have seen, without ether, as marked symptoms from the instillation of eight or ten drops of a one-per-cent. solution of atropia into the eyes, and very much more marked symptoms in an adult from three-eighths of a grain taken by mistake. I attributed the mildness of the symptom from such a dose in my case to the antidotal power exercised by the ether over the atropia. The bromides suggested many years since to counteract some of



the ill effects of ether, I employed for a year, but with no experience that led me to continue their use. In common with all surgeons, I insist that the patient's stomach shall be empty for a few hours before the operation. I decline, except in rare emergencies, to operate when the stomach contains food. On the other hand, I prefer not to have the stomach too long empty, not more than two or three hours, and I give the preference over every other article of diet for the meal before the etherization to coffee, which for its nervous and cardiac supporting effect cannot, I think, be excelled. Alcohol as a stimulant before the anæsthetic I have not used for many years. If the patient is not accustomed to its use, I think it adds to the liability to nausea and vomiting, and if given as a heart stimulant, I have preferred the stimulation of the ether. I have preferred also not to give a laxative as a routine thing, before the operation, but to be satisfied with an enema to unload the large intestine and reserve the laxative for those cases where we need to keep the intestine quiet after operation, or where there are evidences that some objectionable substance is in the bowel producing irritation. In regard to the method of administration, I much prefer the so-called open to the closed method. The fundamental error, it seems to me, is in using too large a dose of ether and in producing a too rapid anæsthesia. We are supported in this faulty practice by the direction that ether should be given as concentrated as possible, with not more than 5 per cent. of atmospheric air. I think it is almost a matter of demonstration that most of the ordinary ill effects that are attributed to the ether are really due to the method of giving it, and that the so-called stage of excitement, the accumulation of mucus in the respiratory tract, cyanosis, laryngeal spasm, nausea, and vomiting can be prevented by a more rational mode of etherization than has prevailed until within a few years; and it is not too much to claim for the open method that it will lessen the liability to bronchitis, pneumonia, suppression of urine, and even death. It is not strange that an agent so potent for good should be as potent

for evil under adverse circumstances; nor is it to be wondered at that the rule for giving ether that was laid down over fifty years ago, when it was first introduced, should need by experience gained in its administration some even radical modification.

Any form of inhaler is satisfactory through which the patient can receive an abundant supply of air as fresh as is consistent with etherization, and one through which the waste material expired from the lung can find easy exit, for it is irrational to make a patient breathe over and over again vitiated air. Allis's inhaler is the one I have used, and has proved satisfactory. But there is much besides the inhaler necessary to secure the best results. It is a misnomer to call a method open when the top of the rubber cylinder is folded down or a towel is thrown over the opening. The instrument gives the opportunity to the etherizer to administer the anæsthetic in the best way, but it does not compel him to do so; and, if one is so disposed, he may crowd the ether perhaps better with an Allis's inhaler than even with a cone, which needs to be removed in order to add a fresh supply, and gives the patient a chance to get a little fresh air.

A suggestion made by my friend, Dr. E. R. Squibb, some years since, is of value, and might be more generally adopted,—namely, to place the can of ether in the hands of the patient and let him inhale the vapor for a few minutes before the inhaler is placed over the face. This familiarizes him with the odor of the ether, lessens the irritability of the pharynx to the first fumes of the ether from the inhaler; and the warmth of the hands that hold the can causes enough vapor to be inhaled to produce a decided action. I have seen the doctor by this means produce very marked drowsiness that needed little more ether to be converted into complete unconsciousness. The ether should never be poured into the inhaler, but dropped into it with as much regularity as the hand of the anæsthetizer can secure, very slowly at first, and at no time more than two drachms to the minute. In this way a regular and constant supply of ether is inhaled, and, on an average,

seven minutes are occupied to produce complete unconsciousness, and from an ounce and a half to two ounces of ether are consumed. An additional two or three ounces will enable the surgeon to perform an operation of an hour's duration. If these suggestions are rigidly followed, the taking of ether, if not at times a pleasant experience, is not a distressing one either to the patient or the surgeon.

I think any one who uses the open method in the manner suggested cannot fail to be impressed with the advantage of it over the closed method. The influence of the morphia and atropia are manifest; the patient breathes quietly, there is little, many times no, excitement, the respiration keeps dry, there is no cyanosis, no spasm of the larynx; nausea and vomiting are exceptional, and, as has been mentioned, the skin remains dry, and the patients come out from under the influence of the ether with comparatively little discomfort.

With this mode of administration, I have not thought it necessary to substitute any other anæsthetic for ether on account of the danger that may accompany or follow its use in pulmonary, cardiac, or renal disease. Guarded in the way above described, it may be used safely in pulmonary disease, and is little likely to cause bronchitis or pneumonia; it is a heart stimulant, and, where the kidneys are healthy, there is accumulating evidence to show that it will only, in rare instances, produce a temporary albuminuria, and where the kidneys are diseased, only a temporary aggravation of the condition; and instead of being contraindicated in laryngeal stenosis, it is to be preferred to other anæsthetics, because it counteracts the danger of death by heart failure, so common in this condition. I have operated recently in a case of appendicitis complicated with aortic stenosis and hypertrophy of the heart, with not the least disturbance in the circulation or respiration; in another case of amputation of the breast with interstitial nephritis with no untoward symptoms, and several years since on an old man of seventy with osteosarcoma of the femur, necessitating amputation at the hip-joint, where the patient was a chronic dyspeptic much emaciated,

had chronic bronchitis, and an attack of pneumonia after entering the hospital, but before the operation. This case also did well, except for a moderately extensive slough in one of the flaps of the stump, and due to the patient's enfeebled condition. So that I think the usual contraindications to the use of ether set down in text-books are based on experience derived from a faulty administration of the anæsthetic.

I would take exception, also, to the practice, more common in Great Britain and on the continent than in this country, of employing a single person to take charge of the anæsthetic. It is a very important part of a surgeon's education to be able to give ether well; and the knowledge cannot be obtained by hearing it described or of seeing it done, but only by actually doing it, and in a sufficient number of cases to make him perfectly familiar with the behavior of the anæsthetic. The anæsthesia does not go quite so smoothly under these circumstances, but, considering the importance of the subject, we owe it to our hospital internes that they shall have a practical mastery of all the details of an operation that we can furnish them. Nor do I think that, under proper supervision, the patients will suffer in new hands, nor will the danger be increased. For deaths that are from time to time reported as due to anæsthetics, especially chloroform, occur usually in the hands of the hospital anæsthetist who has had large experience and knows the dangers of the agents he is using.

I take this occasion to put on record a death under ether and I think due to ether. A male patient, aged twenty-five years, a clerk, strong, rather spare, but one with no constitutional disease, heart, lungs, and kidneys healthy. I operated on him by excising a large varicocele, confined to the left side, on the evening of April 25, 1898. He had never had syphilis, nor was he an alcoholic. He had no apprehension about taking ether. His stomach was empty, and he had no nausea nor vomiting before or during the operation. I directed the morphia and atropia to be given, but for some reason it was not administered. An Allis inhaler was used, and a fresh

can of Squibb's ether. He was breathing the ether in all thirty minutes, and the quantity of ether used was six ounces. He took the anæsthetic well, with no excitement and no need of restraint, and no cyanosis, and was fully under its influence in five minutes. He lost little blood during the operation. The vein was ligated by two ligatures and cut between them. I had occasion to make only two suggestions to his physician, who was giving the ether,—not to let him come out from the ether, as he showed signs of returning consciousness after the first incision, and a few minutes later to hold up on the ether, as he was getting a little more than I thought he needed, but not enough to produce stertorous breathing. As I began to sew up the wound a small quantity of very black blood came from the upper end of the wound. I tied the vein from which it came, and asked the doctor the condition of his pulse, felt it myself, and found him almost pulseless and very pale. He was still breathing; but in spite of efforts to save him he died, the heart ceasing to beat before the respiration. Unfortunately, there was no autopsy; but in view of all the facts I think the death may be fairly ascribed to ether. As usually administered, the quantity—six ounces—of ether was not large; but it was nearly twice as large as was necessary and that I am accustomed to use in this length of time. A death under such circumstances is peculiarly distressing to the surgeon, because the operation was one of expediency and not one of necessity, and, even if undertaken, could well have been performed under cocaine anæsthesia.

When dangerous symptoms develop, either during the use of ether, as in the case just related, or subsequently from a pneumonia, bronchitis, or suppression of urine, I have no experience that would lead me to emphasize the value of remedies other than those which are in common use. The only claim made in this paper is that a proper administration of ether will prevent most of these outward symptoms and conditions. One of the most noticeable features of the method I have recommended is the comparatively few instances in which nausea and vomiting occur. As a result of

tabulated cases, observed by my assistants and myself, I can state that less than 10 per cent. are troubled with this complication, and then only slightly. What nausea the patient suffers is precipitated by moving the patient for the purpose of applying binders, lifting the head, or shifting him from the table to a stretcher, etc. and this continues but a short time. Very exceptionally persistent nausea occurs, and the elimination of the ether seems to be our reliance for the relief of the irritability of the stomach. If I should single out the two most reliable means that I can depend on to lessen the dangers and disagreeable symptoms of ether, I should mention first, as the more important, the proper administration of the anæsthetic, and, secondly, the use of morphia and atropia before the operation.

## REMOVAL OF BILIARY CALCULI FROM THE COMMON DUCT BY THE DUODE- NAL ROUTE.<sup>1</sup>

By CHARLES MCBURNEY, M.D.,

OF NEW YORK,

SURGEON TO THE ROOSEVELT HOSPITAL.

CASE.—Eliza M., forty-four years of age, came under the care of the writer on the 12th of April, 1898. Fourteen months before she had a sudden attack of moderate pain, referred to the right hypochondriac region, and radiating into the right shoulder and across the abdomen. The pain subsided after a few days. During this attack the stools were noticed to be of a white color. A month later a much more severe attack occurred. Intense pain was felt throughout the upper part of the abdomen, and on the following morning deep jaundice was noticed. The acute symptoms lasted for two days throughout a period of four weeks. During the next five months six or seven similar seizures occurred, and some of these are said to have been accompanied by fever. During the last eight months there have been no attacks of real severity, but jaundice of varying intensity has been continuous throughout this period, and the stools have been always clay colored. The evacuations have been carefully examined for some six months, but no foreign material has been discovered. The patient's weight during this period has fallen from 119 pounds to ninety-six pounds. At present no pain is felt. The patient, when she came under my observation, was deeply jaundiced, without pain or tenderness on pressure, and physical examination detected a very much enlarged liver. Her temperature was normal; her pulse 100. The diagnosis lay between calculus obstructing the main bile-duct and carcinoma, the existence of

<sup>1</sup> Read before the New York Surgical Society, May 11, 1898.

calculus being favored, on account of the absence of cachexia and gastric symptoms.

Operation was done on the 15th of April, 1898. A vertical incision, five inches long, was made through the skin, beginning just below the ninth costo-chondral articulation on the right side, passing through the rectus muscle parallel to the course of its fibres, about two inches from the median line. The liver was at once noted to be much enlarged and congested. Firm adhesions existed between an atrophied gall-bladder and the duodenum. Palpation of the gall-bladder failed to detect the existence of calculus within; the cystic duct seemed to be in a normal condition. Examination of the common duct revealed no abnormality until its extreme lower end was palpated through the anterior wall of the duodenum. Here a firm, hard body, apparently about an inch in diameter, was readily felt. This body seemed to be located at a point corresponding to the lower end of the duct just before the latter opened into the duodenum. Adhesions were so strong, and the situation of the mass so low down and so far behind the duodenum, that its examination from the posterior aspect of the duodenum was hardly possible. It was evident that a biliary calculus formed the centre of this mass. The duodenum was incised vertically at the middle of its descending portion, the incision made being about one and a half inches long. The orifice of the common duct was found on the posterior wall of the descending portion of the duodenum, directly opposite the incision just referred to. A probe, introduced through this orifice, immediately came in contact with a calculus. Slight enlargement of the mouth of the duct with the scalpel permitted the end of the calculus to be seen. The finger being then passed behind the descending portion of the duodenum, the lower end of the common duct containing the calculus was easily pushed forward into the incision, in the anterior wall of the gut, and a little additional pressure being made with the left hand, with the right the incised orifice of the duct was pushed back from the calculus, allowing the latter to at once escape into the intestine. A probe was then introduced, which passed freely up the common duct, but no other calculus was found. Bile flowed freely into the intestine as soon as the stone was removed. The wound in the duodenum was now closed by three rows of fine catgut sutures, the application of these sutures being very easy and



complete. The surface of the intestine and the surrounding area of the abdominal cavity was then carefully washed with hot saline solution, and the wound in the abdominal wall was completely closed, in separate layers, with catgut sutures. The skin wound was closed with silk, a bit of thin rubber being introduced at the centre to drain the subcutaneous cellular space. The gall-stone removed was oval in shape, hard, dirty-brown in color, and measured three-quarters of an inch in one diameter and one-half inch in the other. No nausea followed the operation, and no pain. On the following day only sterile water was administered by the mouth, nutrient enemata being given per rectum every four hours. Two days after operation a large ordinary enema produced a natural movement of a light color. The wound healed in a perfectly aseptic manner, the discharges from the bowel rapidly recovered a normal appearance, and on the 1st of May the patient reported herself as feeling perfectly well. Five days after operation the temperature became normal, and has remained so ever since.

The operation, which I have just described, was devised by me some six years ago, while I was operating upon a patient who was in an extreme condition of debility, deeply bronzed with bile pigment, who had suffered for many years from obstruction of the common duct. A year previous to my operation the diagnosis of carcinoma of the liver had been made by a prominent consultant of this city, and the advice was given that she be removed to her home, as she must inevitably die. At the end of the year, no especial change having occurred, her husband, who was a physician, brought her once more to New York, and it was then that the operation to which I have referred was done. On opening the abdomen I found a much enlarged and engorged liver, an atrophied gall-bladder, containing no calculi, moderate adhesions covering the cystic and common duct, which were, however, easily broken down, allowing of complete palpation of the entire bile-track. With one finger behind the duodenum and another depressing its anterior surface a large, hard mass was readily discovered lying behind the centre of the descending portion of the duodenum. This was

clearly a calculus. I at first made a somewhat prolonged effort to so raise the duodenum and bring the lower end of the common duct into view as to enable me to open the latter and extract the stone. I found that this was quite impossible, for I could neither bring the lower end of the common duct into view, nor, if I opened it, could I expect to be able to suture it. It occurred to me that if I entered the duodenum through the anterior wall of its descending portion I should come at once to the point where the duct joined the intestine. I therefore made a vertical incision, about one and a half inches long, at the point referred to, and found the papilla which marked the entrance of the common duct, directly opposite the incision. A probe was introduced without difficulty, which, after passing about half an inch upward through the duct, came in contact with a firmly impacted stone. The orifice of the duct was first slightly incised, then with the aid of forceps largely stretched, until it was possible without difficulty to dislodge the calculus and draw it down into the intestine. Large quantities of bile immediately flowed into the gut. The wound in the intestine was then sutured with three rows of silk. The parts that had been exposed were carefully cleansed and the abdominal wound sutured with catgut, leaving only a small orifice for drainage by means of a piece of iodoform gauze. The drainage material was removed at the end of two days, and, although the superficial wound was somewhat slow in healing, the patient made a complete recovery without fever or other abnormal sign of any kind. Her weight, which had been reduced to ninety pounds within six months, has returned to her normal standard of 180. Since that time I have frequently seen this patient, and she has remained in robust health up to the present date.

In all I have performed this operation on six different occasions, the last one less than a week ago, and in no instance has the slightest hesitation in the healing of the wound in the intestine been noted. One patient, who had always suffered from an excessively irritable stomach, died after pro-

longed and uncontrollable vomiting. No sepsis or wound disturbance of any kind was found in this case.

It seems to me that this operation has a very legitimate place in gall-bladder surgery, and one which has not been sufficiently appreciated. Why it has not been more frequently resorted to by others I do not understand, unless it is from the traditional fear, which dates back to a period long before intestinal surgery was understood, of opening and suturing a piece of gut. When a gall-stone lies in the common duct, at any point in the upper two-thirds of that passage, the approach to it through the wall of the duct is not difficult. In most cases, however, the management of the wound in the wall of the common duct is by no means simple, for although the wound may be left open and the space about it drained through the anterior abdominal wall with comparative safety, yet, of course, one would much prefer, when it is possible, to avoid long-continued drainage with its accompanying dangers. Suture of a wound in the common duct can occasionally be accomplished with comparative ease, more especially if the patient is thin and no adhesions exist to interfere with clean intraperitoneal work; but very frequently the complete suture of a wound in the common duct is exceedingly difficult, especially when the wall of the duct has become much thinned by distention, and successful suture may be quite impossible. When a stone is situated at the extreme lower end of the passage, and when it cannot be dislodged to a place higher up in the duct, its removal without opening the intestine is a matter of great difficulty and not a little danger. Under such circumstances it seems to me that the removal of the stone through the intestine—or rather by the duodenal route—is clearly indicated, there being no possible objection to the method, excepting the fact that the intestine is necessarily incised. When one remembers, however, how much easier, on account of proximity, it is to suture the anterior wall of the duodenum than to suture the incised wall of the common duct, and when one remembers the rapidity and perfection with which properly sutured intestinal

wounds heal, the choice of operation in suitable cases seems to me to lie clearly in favor of the method which I have described. My conviction is that this operation has a much wider application than I have thus far given it, and my experience would lead me to prefer this plan for the removal of a calculus situated at almost any point from the termination of the cystic duct to the point of entrance of the common duct into the duodenum. I have found the orifice of the duct very easily dilatable, and it may be freely incised for at least half an inch with perfect safety. The operation is quicker, cleaner, and safer, in my opinion, than the operation which is usually done. It has also the advantages that, by the introduction of a probe, the bile-ducts can be examined for a long distance upward towards the liver, and also, the orifice of the duct having been dilated to a large extent, there is far less likelihood that overlooked fragments of gall-stone, granular material, or thick bile will be retained and give rise to further obstruction.

REPORT OF EIGHT CASES OF PENETRATING  
GUNSHOT WOUNDS OF THE ABDOMEN,  
WITH INJURY TO THE HOLLOW  
VISCERA.

By RANDOLPH WINSLOW, M.D.,

OF BALTIMORE,

PROFESSOR OF ANATOMY AND CLINICAL SURGERY, UNIVERSITY OF MARYLAND.

THE practice of opening the abdomen in all cases of penetrating wounds, and in most cases, even, where there is a suspicion that the peritoneal cavity has been entered, is now so fully recognized as being the proper procedure that one no longer has to defend himself from criticism or censure for the performance of this operation. On the contrary, he would be severely condemned if he allowed a patient to die, after such an injury, without attempting to rectify the damages by an operation. Such being the case, one has not the same excuse for reporting cases of penetrating wounds, in which laparotomy has been performed, as formerly. However, it is only by the collation of large numbers of similar cases that correct ideas can be formed in regard to the mortality of penetrating abdominal injuries, with and without operation, the time at which laparotomy should and should not be done, the point at which the incision can be made most advantageously, the best methods of repairing the various lesions of the hollow and solid viscera, the question of drainage or no drainage, and many other points which are still somewhat in doubt. As a slight contribution to the attainment of the above objects, I desire to put on record the results of my work in this class of cases.

CASE I.—*Gunshot Wound of the Small Intestines; Laparotomy; Recovery.*—P. D., white, aged sixty years, was admitted

to the University Hospital on December 22, 1893, at 1.30 A.M. About 6.30 P.M., the previous evening, he was shot, with a pistol, by a watchman on the Baltimore and Ohio Railroad, and was first taken to his home, and thence to the hospital. He was a spare, healthy man, and was not suffering from shock when admitted. The ball entered the abdominal wall about four inches to the inner side of the right anterior superior spine of the ilium, and about the same distance above Poupart's ligament, and passing through the ilium, could be felt under the integument of the right buttock. He was not seen by me until noon of the 22d, eighteen hours after he was shot. Under chloroform anæsthesia an incision was made through the track of the bullet, which led into the peritoneal cavity. The incision was enlarged, and considerable dark blood was found free in the abdominal cavity, which was flushed out with hot water. Some fæcal and foreign bodies and adherent blood-clots were also found in the peritoneal cavity. The small intestine was penetrated in four places, in the neighborhood of the ilio-cæcal valve, three of the wounds being close together, whilst the fourth and largest was an inch in length and situated about ten or twelve inches from the others. Two of the wounds were separated from each other by only a narrow bridge of intestinal wall. Three were small, and required from four to six Lembert sutures for their closure, whilst the fourth, which was large, nearly horizontal in direction, and with widely everted edges, was sutured with ten or twelve Lembert sutures, the line of suturing being transverse to the long axis of the bowel, in order to avoid an undue narrowing of the gut at that point. As there was some bleeding from behind the peritoneum, the incision was not sutured, but was packed with gauze. The patient was somewhat shocked by the operation, but rallied promptly. Some vomiting followed as a result of the anæsthetic. He was sustained with nutritive enemata for several days, and at the expiration of five days began to take small quantities of milk by the mouth. Previous to the operation his temperature was  $101^{\circ}$  F., and pulse 104; on the evening after the operation his temperature was  $99\frac{3}{4}^{\circ}$  and pulse 120. The gauze packing was removed on December 28, the incision closed with buried sutures, and union promptly occurred. On January 4 there was an elevation of temperature and an induration was found in the right iliac fossa. The induration was

incised and some pus escaped, and a free hæmorrhage occurred. As the vessel could not be ligated, the wound was packed. On January 10 a pulsating lump was discovered in the right iliac fossa, and the patient was again anæsthetized, a free curved incision made along and above Poupart's ligament, the deep circumflex artery exposed and ligated, and a mass of decomposing clots removed from behind the peritoneum. From this time the patient made an uneventful recovery. In this case a median laparotomy was not done, as it was known that the bullet only traversed the right side of the abdomen, and could be felt under the integument of the right buttock, from which position it was excised some days later. The ball had cut the deep circumflex iliac artery and then passed through the ilium. The man is still living in good health.

CASE II.—*Gunshot Wound of the Stomach; Laparotomy; Recovery.*—S. W. R., white, aged fifty-eight years, contractor by trade, was admitted to the University Hospital on July 4, 1895. As he was crossing a vacant lot, some boys fired a small cannon loaded with buckshot, the boys being on an elevation. A shot struck him in the left side, just below the apex of the heart. He staggered, but did not fall, and, boarding a street car, came to the hospital, walking a distance of more than three squares from the cars to the institution. An examination with a probe showed that the wound led into the peritoneal cavity, and shortly afterwards blood was vomited in clots, showing an injury to the stomach. Under anæsthesia an incision was made in the left hypochondriac region, parallel with the costal arch, exposing the stomach. A perforation was found in the anterior wall of the stomach, from which gas escaped, but no extravasation of the contents had occurred. The opening was closed with Lembert sutures, and, after removing the discolored edges of the bullet-track with scissors, the external incision was sutured. No other perforation of the stomach could be found, and it is uncertain what became of the bullet, as it was never found in the fæces. Subsequently he vomited blood-clots several times. He was kept in bed, absolutely quiet, and no food given for several days. There was but little reaction following the operation, the temperature reaching  $100\frac{2}{3}^{\circ}$  F.; pulse, 88. A severe bronchitis set in on the fourth day, but this was of short duration. The external wound suppurated, but as the peritoneum had been su-

tured separately, the abdominal cavity was not invaded. He left on August 6, well.

CASE III.—*Gunshot Wound of the Small Intestines; Laparotomy; Death from Peritonitis.*—E. J., colored, aged twenty-five years, was admitted to the University Hospital on September 8, 1895. He was shot about 10 P.M., by a negro man, and was brought to the hospital about an hour later. An examination revealed a scratch three inches in length on the left buttock, made by a shot, a slight contusion over the seventh and eighth ribs, and a wound on the left side of the abdomen, about four inches above Poupart's ligament, and two inches from the median line. The clothing and skin were blackened with powder. At midnight the patient was placed under chloroform, and an exploratory incision made at the site of the wound, which was found to lead into the peritoneal cavity. A median laparotomy was then done, the incision extending from the umbilicus to the pubes. At this time the patient was in good condition, no shock having occurred. Five perforations of the ileum were found and three of the mesentery. There had been but little hæmorrhage, and no escape of intestinal contents. The bleeding vessels were ligated, and the perforations in the mesentery closed. The five intestinal perforations were closed with two rows of Lembert sutures, and what was supposed to be a careful search of the intestines for other perforations was made. The abdominal cavity was flushed with warm sterilized water, and the external incision closed without drainage. The patient collapsed under the operation, and it became necessary to complete the toilet with less care than would otherwise have been taken, and it was noticed that some bloody serum continued to well up from the peritoneal cavity. In addition to the collapse of the patient, his abdominal walls were of unusual rigidity, and, although he was almost eviscerated, subsequent events showed that the search had not been sufficiently thorough. The patient was put to bed, stimulated, and external heat applied to his body. September 8: The patient is very comfortable and seems to be doing well. September 9: Slept well last night; is somewhat restless, and has some soreness and pain in the lower part of the abdomen. September 10: Has no nausea, but vomits violently and frequently. He has taken no food and the dejecta consist of a yellowish-green fluid. An enema of oleum terebinthinæ, one



fluidounce; magnesiae sulphatis, two ounces; glycerini, one fluidounce; aquæ, ten fluidounces, was given, and caused free movements of the bowels. Croton oil, one drop, was given by the mouth; and strychniae sulphatis, one-thirtieth grain, administered by hypodermic injection every four hours. September 11: Had five movements up to 11 A.M. The upper abdomen is much distended, showing the contour of the stomach. He vomited frequently until 8 P.M., when another drop of croton oil was given, and the distention of the stomach and abdomen disappeared. September 12: Had a fairly good night, but was troubled with hiccough. Has not vomited since eight o'clock last night; bowels moved and wind passed per anum. He died on the night of September 12. An autopsy revealed a general peritonitis and an undiscovered perforation in the angle of junction of the ileum with the cæcum. The bullet was found in the cæcum. The other intestinal wounds had healed firmly. His highest temperature was 101° F.; pulse, 128. The death of this man is especially to be regretted, as he was operated on within two hours after being shot, and there was no extravasation into the peritoneal cavity, but the search seemed to be as thorough as could be made under the circumstances, with the patient collapsed, and the operating table almost inverted. He did badly under the anæsthetic from first, and remained very rigid.

CASE IV.—*Gunshot Wound of the Abdomen; Laparotomy; Death.*—B. F. T., white, aged sixty-six years, gatekeeper at House of Refuge, was shot by an inmate about eight o'clock on the morning of September 2, 1896, and was admitted to the University Hospital within an hour. He had been a United States man-of-war's man, a Confederate soldier, and a Baltimore policeman, and when a boy, trying to escape, ordered him to stand aside or he would shoot him, the old man stood bravely to his post, and received the bullet in his abdomen. He then closed the gate and called for assistance, and was conveyed to the hospital, a mile distant, in the ambulance. The bullet entered the right side of the abdomen, and median laparotomy was done as soon as he could be prepared for operation, about two hours after he was shot. Seven holes in the small intestine were sutured, and, a search not revealing any further wounds, the abdomen was closed. He was not at all shocked by the operation, and seemed to be in a favorable condition. Vomiting of blood

soon set in, and he died with symptoms of peritonitis on September 3. The coroner's inquest revealed an additional wound in the sigmoid flexure, and the No. 38 ball lodged in the left side of the sacrum. The bullet had traversed the abdomen from the right side to the left. I cannot account for the vomiting of blood, unless some of the wounds of the small intestine continued to bleed after being sutured.

CASE V.—*Gunshot Wound of the Liver, Small Intestines, and Mesocolon; Laparotomy; Recovery.*—S. T., colored, aged twelve years, was shot with a No. 22 pistol on September 4, 1897, at 5 P.M., and was admitted to the University Hospital about five hours later. The bullet entered the abdomen slightly to the right of the middle line and about midway between the ensiform cartilage and the umbilicus. Laparotomy was done about 11.30 P.M., the incision, four inches in length, passing through the bullet-wound and extending to the level of the navel. Upon opening the abdomen a considerable quantity of blood-clots was found, and, upon removing these, it was seen that the missile had passed through the thin edge of the right lobe of the liver, making a track about one inch in depth through this organ; it then traversed the transverse mesocolon, and wounded the jejunum in five places. The intestinal wounds were ragged, with everted edges, and liquid feces escaped from the openings. From four to six Lembert sutures, of silk, were required for the closure of each wound, the suturing being transverse to the long diameter of the intestinal canal, in order to prevent any contraction of its lumen. The intestines were cleansed, and gauze was packed around the wounds in the liver, and strips allowed to project from the external wound, which was sutured. He was not much shocked by the operation, but strychniæ sulphatis, one-sixtieth grain, hypodermically, was administered every three hours during the first twenty-four hours. Whiskey, twenty minims, was given hypodermically every fifteen minutes for three hours. No food or drink was given during the first night. On the next day enemata of cold water, six ounces, were given every three hours for twenty-four hours, to slake thirst. On the second day three ounces of peptonized milk were administered by rectum every three hours, in addition to the water. An enema of one pint of warm water was thrown into the rectum to move the bowels, which was effective. The abdomen was soft and but slightly painful.

On the third day the peptonized milk by enema was increased in quantity.

On the fourth day beef-tea, one ounce, was given every two hours, and water, one ounce, every hour, *per os*. On account of pain it was necessary to give morphia hypodermically. The gauze packing was removed from the abdominal cavity, which caused considerable pain.

On the fifth day, one ounce of milk and two ounces of beef-tea every hour, alternately, were permitted.

Bowels moved at intervals on the sixth day.

The stitches were removed on the ninth day, the wound healed, but with slight suppuration of the stitch-holes. He was very troublesome in pulling off the dressings, and it became necessary to tie his hands.

On September 5, the morning after operation, his temperature was  $101^{\circ}$  F.; pulse, 116; respirations, 32: P.M., temperature,  $101^{\circ}$ ; pulse, 120; respirations, 36. Considerable pain and meteorism.

September 6, A.M., temperature,  $98\frac{3}{5}^{\circ}$ ; pulse, 112; respirations, 32: P.M., temperature,  $99\frac{1}{5}^{\circ}$ ; pulse, 110; respirations, 28.

September 7, A.M., temperature,  $97^{\circ}$ ; pulse, 108; respirations, 28: P.M., temperature,  $99\frac{1}{5}^{\circ}$ ; pulse, 110; respirations, 30.

September 8, A.M., temperature,  $99\frac{2}{5}^{\circ}$ ; pulse, 98; respirations, 26: P.M., temperature,  $100\frac{1}{5}^{\circ}$ ; pulse, 96; respirations, 30.

September 9, A.M., temperature,  $99^{\circ}$ ; pulse, 88; respirations, 26: P.M., temperature,  $100\frac{2}{5}^{\circ}$ ; pulse, 96; respirations, 30.

September 10, A.M., temperature,  $99\frac{3}{5}^{\circ}$ ; pulse, 94; respirations, 26: P.M., temperature,  $99^{\circ}$ ; pulse, 78; respirations, 24.

September 11, A.M., temperature,  $99\frac{2}{5}^{\circ}$ ; pulse, 86; respirations, 24: P.M., temperature,  $99^{\circ}$ ; pulse, 80; respirations, 24.

September 12, A.M., temperature  $98\frac{2}{5}^{\circ}$ ; pulse, 86; respirations, 20: P.M., temperature,  $98\frac{2}{5}^{\circ}$ ; pulse, 70; respirations, 20.

The subsequent course was afebrile, except for an intercurrent attack of acute tonsillitis, when the temperature shot up suddenly to  $104^{\circ}$  F. on the twenty-first day. A microscopical examination of his blood made previously had not shown any malarial organisms, but the temperature fell over  $6^{\circ}$  in the following twenty-four hours, under the administration of quinine. He was allowed soft toast, eggs, and mashed potatoes in about three weeks, and returned to a normal diet in a month. This

patient was shot accidentally by his brother, who was loading the pistol; was first seen by Dr. Eareckson, of Elkrige, Md., and was transported nine or ten miles to the city, and had been wounded about six hours before laparotomy was done. The bullet was not found, nor, so far as is known, did it pass per rectum. He was in good health at the time of injury.

CASE VI.—*Gunshot Wound of the Small Intestines; Laparotomy; Recovery.*—E. A. B., white, aged forty-four years, carpenter by occupation, was shot by his son, with a pistol, on September 6, 1897, about 3 P.M., and was admitted to the University Hospital one hour later. The bullet entered the abdomen about one inch to the right of the middle line, and one inch below the navel. Laparotomy was performed at 5 P.M. The patient was a strong, well-developed man, who at first declined to have an operation done, as he thought he would die in either case, but upon being informed that about 50 per cent. of our cases of gunshot wounds of the abdomen had recovered he consented to laparotomy. The incision passed through the track of the bullet, and revealed six ragged holes in the small intestines, and one through the great omentum. All bleeding vessels were ligated, and the wounds in the intestines were closed with rectangular Lembert sutures (mattress sutures), the line of sutures being placed transversely to the long axis of the intestine, in order to prevent any narrowing of its lumen. This operation, like most of those performed for similar injuries, was done by artificial light. He was not materially shocked by the injury or operation, and was put to bed in fairly good condition. Nothing at all was given him to eat or drink until the next day, when six ounces of cold water were given, by enema, every three hours to allay his thirst. Ice-water, one ounce, was given *per os* every hour on the second day, as the weather was intensely hot, and the patient's temperature elevated. On the third day, beef-tea was given, one ounce every hour, and a large enema to empty the bowels. On the fourth day the beef-tea was increased in quantity, alternating with small quantities of milk. The bowels were kept open with enemata, and beef-tea and milk, with whiskey and crushed ice, were allowed, being gradually increased in quantity. Strained soup was given at the expiration of a week. He was not allowed to eat anything more solid until more than three weeks had elapsed, when soft bread and eggs were added to his diet, and in

about one month he was permitted to return to an ordinary diet. The abdominal incision was not tightly sutured, and gauze was left projecting from the abdominal cavity for drainage. On September 7, the morning following the operation, his temperature was  $102^{\circ}\text{F}$ .; pulse 112; respirations, 36: P.M., temperature,  $102\frac{3}{4}^{\circ}$ ; pulse, 142; respirations, 38; his abdomen was tympanitic, and there was vomiting. He looked like a very sick man, and peritonitis was thought to have set in; a stitch was therefore cut and the gauze removed; this was followed by the escape of a considerable quantity of bloody serum. Fresh gauze was placed in the now open abdominal cavity. By the next morning there was a marked amelioration of his symptoms; temperature,  $100\frac{1}{4}^{\circ}$ ; pulse, 122; respirations, 34: P.M., temperature,  $101\frac{3}{4}^{\circ}$ ; pulse, 132; respirations, 32. September 9, A.M., temperature,  $100\frac{3}{4}^{\circ}$ ; pulse, 104; respirations, 28: P.M., temperature,  $101^{\circ}$ ; pulse, 96; respirations, 30. On September 11 the weather was excessively hot, the thermometer standing at  $97^{\circ}$  in the shade, and there was a sudden rise in the temperature of the patient to  $103\frac{3}{4}^{\circ}$ ; pulse, 96; respirations, 24. As the patient's general condition was satisfactory, this increased fever was attributed to the very hot weather, and, as a matter of fact, most of our operative cases showed an elevation of temperature at that time. On the 12th this patient's temperature fell to  $99^{\circ}$ , and his pulse to 72; and on the 13th the temperature was subnormal, and pulse 68. The subsequent course was practically afebrile. The sutures were not removed until the fourteenth day, when the incision was found to be healed, except where the gauze had been packed. Secondary sutures were inserted, and the whole wound healed firmly. After convalescence was established the pulse-rate decreased to 60 beats per minute, subsequently increasing to normal. He left hospital well on October 28, and returned to work.

CASE VII.—*Gunshot Wound of the First Portion of the Duodenum; Laparotomy; Recovery.*—T. F., colored, aged twenty-three years, was shot with a pistol on September 14, 1897, at 11 P.M., and was admitted to the University Hospital at 9 A.M., on the fifteenth. He was first seen by Dr. Eareckson, of Elkridge, and was transported nine or ten miles to the city. The bullet entered the right side of the abdomen, about the tip of the eleventh costal cartilage, and an incision was made in the right linea semilunaris, eventually extending from the costal arch

to the pelvis. Operation was done at 10 A.M., eleven hours from the time of the injury. He had vomited the contents of the stomach, but without any admixture of blood. Upon opening the peritoneal cavity it was found filled with dark blood, bile, and intestinal fluids, which had gravitated even into the pelvis. The bullet passed between the liver and stomach, and opened the first portion of the duodenum, making a ragged wound about an inch in length, from which blood, bile, and fluids exuded freely. This opening was closed with considerable difficulty, on account of its inaccessibility, but finally a double row of Lembert sutures was placed, each row consisting of about ten stitches. The peritoneal cavity was flushed with hot sterile water, and carefully mopped out, and a large glass drainage-tube placed between the stomach and liver, and another in the pelvis, and the parts packed with sterile gauze. The lower part of the wound was sutured, and the upper part left entirely open, with gauze sticking out, as it was not thought that recovery could occur if free drainage was not provided.

For the first night the directions were that nothing should be given at all by the mouth; but six ounces of cold water by enema every three hours, to allay thirst, and strychniæ sulphatis, one-thirtieth grain, hypodermically, every three hours, were administered.

On the next day, September 16, six ounces of peptonized milk were given in addition to the water. The wound was dressed, and two drachms of bloody fluid were removed from the drainage-tube.

September 17: Wound dressed and a small quantity of serum removed from the tubes.

September 18: Wound dressed and some gauze removed.

September 19: Both tubes removed and several pieces of gauze. Up to this time the patient had taken no nourishment by the mouth whatever. Milk, one-half ounce every two hours, was now ordered, and the nutritive enemata continued. He had been comfortable, had not complained of hunger or thirst, and his tongue had kept moist.

On September 20 all the gauze was removed from the abdomen, and a stitch abscess opened and disinfected. The milk was increased to one ounce every hour. The milk was subsequently increased and the nutritive enemata discontinued. On

October 2 his diet consisted of milk, soup, soft bread, and soft eggs.

On September 28 that portion of the abdominal wound which had been left open was sutured, except at the very top, and it healed in a few days.

On September 15, P.M., temperature,  $98\frac{2}{3}^{\circ}$  F.; pulse, 90; respirations, 28.

September 16, A.M., temperature,  $99\frac{3}{8}^{\circ}$ ; pulse, 84; respirations, 24; P.M., temperature,  $100^{\circ}$ ; pulse, 72; respirations, 24.

September 17, A.M., temperature,  $98\frac{3}{8}^{\circ}$ ; pulse, 78; respirations, 24; P.M., temperature,  $98\frac{2}{3}^{\circ}$ ; pulse, 76; respirations, 22.

The subsequent course was afebrile, with a very low pulse-rate, dropping as low as 52 per minute during the second week. He suffered little or no pain, and for a man desperately wounded made an absolutely uneventful recovery. The bullet, a conical No. 38, was passed per rectum on the 16th day. Why the bullet did not pass entirely through the duodenum is a mystery, but, in order to be sure that it had not done so, the greater and lesser omenta were torn through and the posterior surface of the stomach and duodenum examined.

CASE VIII.—*Gunshot Wound of the Small Intestines; Laparotomy; Death.*—W. D., white, aged twenty-seven years, was shot accidentally on the afternoon of October 1, 1897, and was brought at once to the University Hospital. The patient, a stout, short, and flabby man, was shot in the left side of the abdomen, the bullet entering about two inches below and to the left of the umbilicus. Laparotomy about two hours after injury, the incision being placed in the median line. There was considerable bleeding, which was controlled by ligating the lacerated mesenteric vessels. The injuries sustained were three holes in the mesentery and five perforations of the small intestine. These were accurately closed, and the abdominal cavity cleansed. The patient took the anæsthetic very badly and the operation had to be completed in haste. He reacted, however, but complained of much pain, and vomited frequently. His temperature fell and his pulse increased in frequency, and death occurred on the third day: temperature,  $99^{\circ}$  F.; pulse, 150. Autopsy: Stitches intact, some plastic peritonitis, but no purulent infection. No perforations were overlooked, and he appeared to have died of acute

sepsis. The operation was performed with as much care as any of the others, but he did badly from the onset.

In addition to the cases reported above, I have performed laparotomy in one instance for a suspected penetrating bullet-wound, in which the bullet entered the epigastrium, but passed upward into the pericardium, the patient making a good recovery, after an acute pericarditis.

I have also opened the abdomen twice for stab-wounds of the epigastrium, with protrusion of the omentum, in one of which the stomach was penetrated, both cases recovering.



REPORT OF A CASE OF STAB-WOUND OF COLON,  
DIAPHRAGM, AND LUNG, TERMINATING IN RECOVERY.

By WILLIAM H. FISHER, M.D.,

OF TOLEDO, O.,

PROFESSOR OF CLINICAL SURGERY, TOLEDO MEDICAL COLLEGE; SURGEON  
TO THE TOLEDO HOSPITAL.

WM. M., aged thirty-three years, under the influence of alcohol, received a stab-wound below the ribs on the left side at 3 A.M., July 6, 1896. After the injury he walked some three blocks. He was not brought to the hospital till the following day, at 9 A.M., when the writer was summoned. The following are the conditions obtained. A strong, well-nourished man, of fine physique, of medium height, semi-conscious, very anæmic, pulseless, respiration impeded and hurried, heart's action weak,—rate, 160 per minute. He was immediately removed to operating room and chloroform administered. On the left side of chest was a large, fluctuating swelling, in the centre of which an incision, two inches in length, had been united by sutures. Removing these and turning out blood-clots, the hæmorrhage persisting and excessive, the original incision was enlarged, parallel to the transverse colon. It was now apparent that the knife had penetrated the abdominal cavity, cut the colon at its splenic flexure, involving but little of the peritoneal portion, but injuring the transverse colon at its attached border between the layers of mesocolon for three-quarters of an inch. From this point, passing upward, it cut the diaphragm two inches, thence into the thoracic cavity, penetrating the lung two inches in length and one inch in width.

The incision in the lung was firmly packed with gauze; four silk sutures were placed in the diaphragm from the abdominal side; a gauze drain was passed to extremity of cut in bowel, and the abdomen was closed. No further measures were practicable on account of the critical state of the patient.

Shock and hæmorrhage had produced a practically moribund state, and most energetic measures were employed for restoration.

The heart's action gradually improved,—rate vacillating from 155 to 130. Vomiting was persistent and frequent during the next four days. He was unconscious during the rest of the day and night.

July 8: Gas and blood-clots passed per rectum. Subsultus, with marked jerking of whole body, due, no doubt, to the free exhibition of strychnia; pulse from 120 to 94; respirations, 32 to 40.

July 9: No change; but slight subsultus.

July 10: Bowels moved three times in morning, black in color, and full of blood-clots. Normal stool in afternoon, and so continued. Pulse and respiration normal. Temperature at no time subnormal nor ever above 101° F.

July 12: Gauze removed from both cavities; no hæmorrhage from lung, and but slight soiling from intestinal contents. Diaphragmatic union complete.

July 13: Dressings soiled by fæcal discharge, and so continued for the following two weeks, when the fistula closed.

With the exception of extensive suppuration of both arms from hypodermics, nothing of further interest is bearing on this case. He was discharged cured August 5, 1896.

Owing to the critical condition of patient during the operation and the length of time necessary to repair the injury of bowel affected in such a locality, it was deemed advisable to simply pack with gauze, thereby establishing a temporary drain and preventing, if possible, any leakage. the anatomical site of injury entering favorably in the employment of this technique.

It was the writer's intention, had the patient rallied, to reopen the abdomen and repair the injury to bowel.

Not being in any condition for operative interference until the third day, and no signs of peritonitis manifesting themselves, the expectant plan was adopted. Removing gauze on the fifth day, it was evident a fistula would be the result. Causing some concern at first, it was a source of

gratification to note changes that demonstrated repair; faecal discharge and suppuration ceased at end of third week.

Had not this favorable termination ensued the abdomen would have been reopened, the cut edges of bowel reunited, and omental flaps, as devised by Senn, grafted upon the uncovered portion of bowel.

Fistulae of intestines between layers of mesocolon are prone to remain permanent, producing much damage.

Fistulae of colon present more difficulties in healing than those possessed by small intestines, while for fistulae of the attached border of colon, failure after failure has been the result after suture.

T. A. McGraw sums up pithily these various phenomena operating against a successful termination when he says:

"The prognosis of all wounds of the large intestines is doubtful, with whatever care they may be repaired."

The greater rigidity of its walls which do not accommodate themselves easily to the infolding by suture, the unequal thickness of the wall, the impervious closure of its upper end by the ileo-caecal valve, and the obstruction offered at the lower by rigid sphincters, the consequent accumulation of gases and distention of the bowel, and, finally, the character of contained faeces, which not only irritate the wound by their presence but also mechanically tear it apart, all tend to destroy the most carefully effected union. When, in addition, the wound is located on the attached surface, where the peritoneal coat is wanting, we have a case of surgery which requires all of the resources of our art to make successful.

Treves, in his "Operative Surgery," speaks of a case of wound of this border, which two operations failed to cure, and other surgeons have had to confess failures in securing union at these points. (ANNALS OF SURGERY, August, 1896.)

Passing now to the diaphragmatic injury, extending two inches in length, which was united with four silk ligatures, closing entirely the abdominal from thoracic cavity and uniting firmly.

The "solution of continuity" of diaphragm produces

grave constitutional disturbances, represented by "a rapid, irregular pulse, due to disturbances of the pneumogastric nerve, a peculiar kind of respiration, in which the thoracic accessory muscles are called into forcible action, loss of visible movements of diaphragm during the respiratory act, a sinking in of the epigastric and hypochondriac regions of the abdomen, great dyspnœa; severe vomiting, intense pain, increased during a paroxysm of coughing and hiccough." (Dennis's "System of Surgery," Vol. iii, p. 234.)

An equilibrium being established, these symptoms abate, the wound does not unite but remains open, and often increases in size.

Hernia will be the result, and, if the wound be small, immediate strangulation may take place.

In this connection it is of interest to note that the diagnosis of strangulated diaphragmatic hernia as a rule has been made at the autopsy.

In Leichtenstern's collection of 250 cases, five were correctly diagnosed before death. (Dennis's "System of Surgery," Vol. iv, p. 214.)

The diagnosis of a rupture of the diaphragm having been made, it is incumbent upon the surgeon to perform a laparotomy and unite the cut surfaces.

Dennis has collected eight cases of rupture of the diaphragm, in which cœliotomy was performed, all of which recovered.

With the exception of this case, the writer has been unable to add to this collection.

In packing the cut surface of the lung the purpose was to control hæmorrhage temporarily, till the amount of damage done could be discerned. It answered the purpose so effectively that it was allowed to remain. Had the writer been compelled to resect the ribs and stitch up exposed surface, as advised by Tillmans, a fatal termination would have resulted.

A CASE OF EXCESSIVE BONE ATROPHY COM-  
PLICATING AN UNUNITED FRACTURE  
IN BOTH FOREARMS OF THE  
SAME INDIVIDUAL.<sup>1</sup>

By EUGENE R. CORSON, M.D.,

OF SAVANNAH, GA.

THE following case is so rare and presents such interesting features that I have no hesitation in reporting it with the accompanying radiographs.

Mrs. G., a Swiss, aged seventy years, widow, presented herself for treatment at the St. James Dispensary. Though applying for relief of a winter cough, the peculiar condition of her left forearm attracted attention, and she was found to have an ununited fracture of the two bones of the left forearm, at the junction of the middle and lower third. Not only did the hand and the distal portion of the forearm hang helpless, but a paralysis agitans of the entire left side existed. She gave the following history: Born in Switzerland of healthy parents, one of six children, all healthy. She had enjoyed good health all her life, with the exception of some rheumatic trouble, never severe enough, however, to confine her to bed. She had one child in a short married life. Ten years ago she fell on the right forearm, severely bruising it, and causing much pain. She applied to a druggist, who pronounced the bones not broken, and gave her a lotion. She was a month in regaining the use of the arm and hand, and has since had good use of it. On inspection it appears to be normal. Five years ago she fell on the left forearm, fracturing both bones, and went to a hospital, where she was treated for one month by a splint and bandage. At the end of that time the non-union was discovered, and an operation ad-

<sup>1</sup> Read before the Georgia State Medical Association, April 21, 1898.

vised, which she declined. About six months ago the paralysis agitans developed, but confined entirely to the left side. She has at present a slight senile bronchitis, troubling her only in the winter. Otherwise she is as healthy and as vigorous as most women of her age. When examined by the fluoroscope, the radius and ulna were found atrophied to points, and I can find no better comparison of the fluoroscopic image of the bones than to pulled taffy. The X-ray examination of the right forearm showed the same condition of the right ulna, though more marked, and resembling even more this pulled taffy appearance. All the other bones seemed normal. The accompanying radiographs show this peculiar condition in a striking way. We are led to believe that the right ulna was fractured at the time of her fall, ten years ago, though not recognized. If not broken, it must have been severely bruised. On carefully palpating the forearms the absence of the bone is quite evident, and on the right side there seems to be a tendinous union between the divided ends. This is not so apparent, if at all, on the left side.

As there seems to be no relation between the bone atrophy and the paralysis agitans, I shall dismiss this complication with a few words, whereas Hirt (*"Diseases of the Nervous System,"* by Ludwig Hirt, New York, 1893) speaks of paralysis agitans confined to one side of the body as a rare condition. Charcot (*"Lectures on the Diseases of the Nervous System,"* delivered at La Salpêtrière, by J. M. Charcot, London, the New Sydenham Society, 1877), on the contrary, states: "It is much more common to see the tremor confined for a long time to the members of one side of the body (hemiplegic type), or to the two lower extremities (paraplegic type)." As the history shows the bone lesion existed ten years in one case, and five years in the other, before the appearance of the tremor, and then only on one side, I fail to see any relationship of cause or effect. The paralysis is evidently in its beginning only, and will undoubtedly increase.

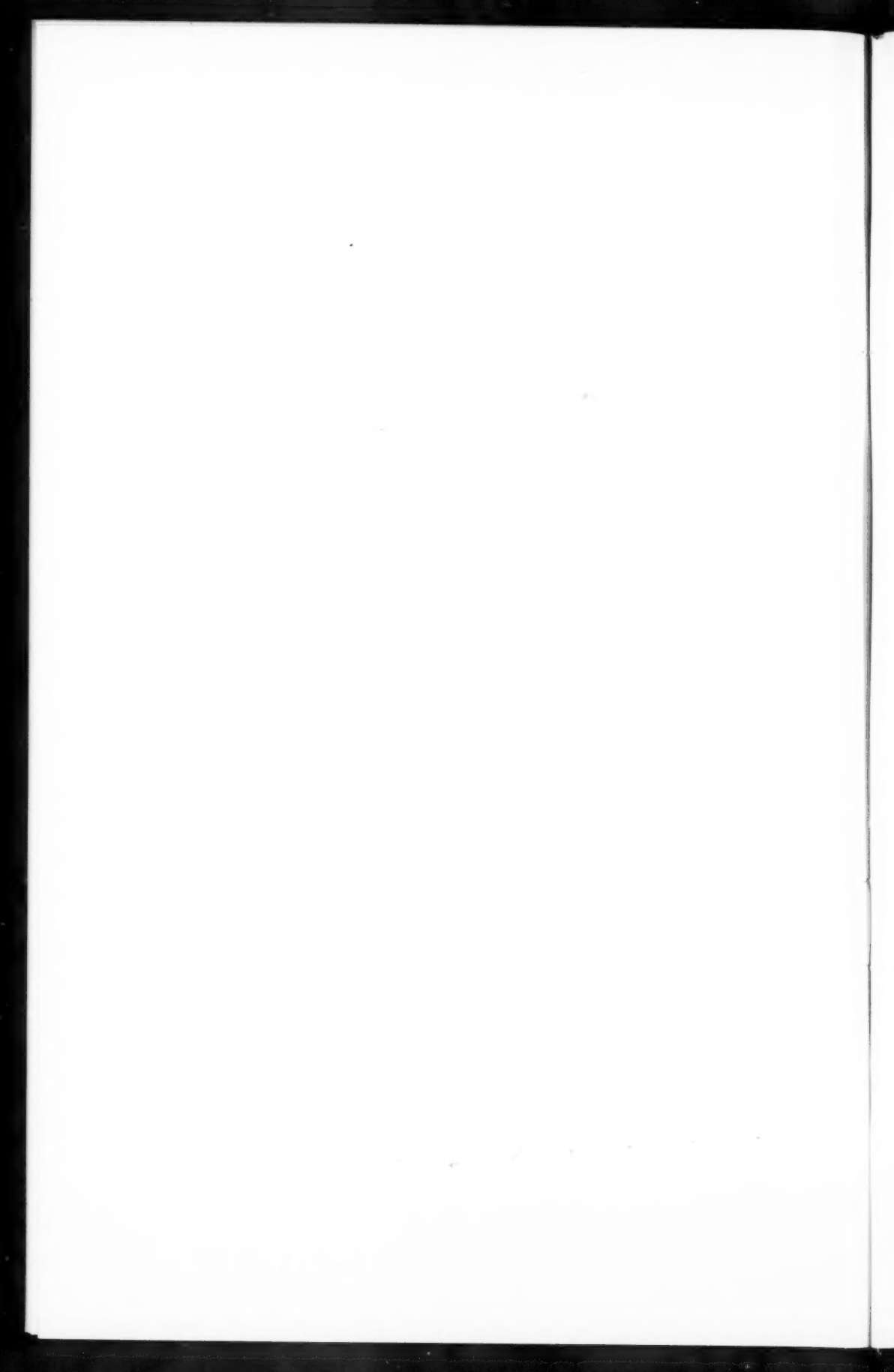
A careful examination of the X-ray negatives shows the following conditions present: The uninjured bones show the eccentric atrophy and osteoporosis of old age. These



Right forearm.



Left forearm.





changes, though apparent in the radiographs, are best seen in the negatives.

*Left Forearm.*—This is shortened about three inches, but can be pulled out almost to correspond with the better side. The proximal ends of the radius and ulna are atrophied to points, the atrophic process extending up within two inches of the joint surfaces. The bones seem to have melted away like icicles. The distal ends are even more atrophied, and the pointing is more abrupt, giving a heart-shape to the fragments. The radiographs show well the twisting of the muscles of the forearm. There is an evident calcareous deposit on the styloid process of the radius, a condition present on the right side. There is a slight luxation of the trapezium and trapezoid on to the second metacarpal, which brings the long axis of the scaphoid in line with the long axis of the forearm; this condition is also present on the right side, and seems to be a senile change. The elbow-joint seems normal as well as the epiphyses of the radius and ulna.

*Right Side.*—Here the atrophy of the proximal half of the ulna resembles that of the left side, except that the pointing is sharper and the atrophic process has extended higher up the bone. The distal end shows very beautifully what I can describe by no better term than a pulled taffy appearance, the bone dwindling to a thread, apparently. The radius is much curved, the bicipital tuberosity encrusted with calcareous deposits. The elbow-joint seems normal.

I know of no similar X-ray findings. I doubt not, however, that some ununited fractures would show a similar condition, though the post-mortem findings heretofore published would still make this condition a rare one.

A glance at the radiograph suggests at once the thought that we have to deal here with a neurotrophic change, due to a neurotrois or nerve injury; that this is an acute process, beginning most probably with a halisteresis or washing away of the bone salts, followed by a more or less complete absorption of the bone-matrix, and leaving only the connective tissue to contract into new fibrous bands or sheaths. The

process seems to be for bone what acute muscular atrophy is for muscle, though in all probability a much rarer condition than the latter, by virtue of the fact that bone is more stable than muscle. And this case also strongly suggests the thought that non-union after fracture depends directly upon nerve injury or impairment of nerve function. This question of non-union after fractures is a most interesting one, and, so far as I know, still awaits a study worthy of present methods and present knowledge in pathology. I know no better paper on the subject than the remarkable one by Dr. George W. Norris, one of the surgeons of the Pennsylvania Hospital, entitled, "On the Occurrence of Non-union After-Fractures; its Causes and Treatment," published in the *American Journal of the Medical Sciences* for January, 1842. Hamilton, in his treatise on fractures, gives this paper all praise and acknowledgment, though, I believe, he would have strengthened his own chapter on the subject by quoting Norris at greater length. Norris's monograph certainly represents all that was known on the subject at that time, and it is doubtful if more is known to-day.

Norris describes four modes of non-union,—

(1) A union by a "callous tumor," remaining cartilaginous and soft, and permitting a free movement of the divided ends of the bone.

(2) No union of any sort between the fragments, the ends of which diminish in size, and are very movable under the skin; the limb is shrunken and hangs perfectly useless.

(3) In this, the most common class, according to him, the medullary canal is obliterated in both fragments, the ends of the bones are more or less absorbed or rounded, or "*are pointed and covered by a tissue resembling the periosteum*, and are connected together by strong ligamentous or fibro-ligamentous bands, passing from the extremity of one fractured fragment to that of the other. Sometimes this band of union is constituted by a single ligament, while in other instances it is made up of several narrow bands having separate attachments; in either case the newly formed substance is firmly

adherent to the bones, and, if any length, is in a high degree pliable."

(4) In the fourth class of cases, "a dense capsule without opening of any sort, contained a fluid similar to synovia, and resembling closely the complete capsular ligaments, is found."

The case before us evidently comes under the third class. Norris describes at length in this paper a case which evidently shows an acute softening and atrophy of bone more striking even than the present one, and which points even more forcibly to a neurotrophic change:

A young man, of eighteen years, broke his right humerus near the middle. A good reunion had started, when he rebroke the arm at the same place. The ends failed to unite, and a rapid process of absorption went on until "the whole of the arm-bone, between the shoulder and the elbow, was at length completely removed." He adds, "Mr. B. now, after many years, presents the spectacle of one short and one long arm. The right forearm and hand are of a size to correspond with the sound one on the left side, and, under certain circumstances, are equally as strong. Ordinarily, the right arm swings hither and thither, like a thong with a weight at the extremity; for the forearm and hand, with reference to the division above the elbow, constitute a pendulum, oscillating according to the movements of the body. Although it is impossible to push with the defective arm, he can draw a burden towards himself with it as strongly and tenaciously as with the other; and in so doing the muscles are elongated, so that the arm is extended to its original length; when the resistance is removed, the muscles instantly shorten themselves about six inches. To show the perfect non-resistance of the apparatus of muscles, arteries, veins, and nerves in the soft, boneless space, we saw him twist the palm of the hand twice round, which, consequently, presented the strange anomaly of having all the apparatus of the arm twisted like the strands of a rope." (*Boston Medical and Surgical Journal*, July, 1838, p. 368.)

I have quoted this case somewhat at length, because I believe it shows the same pathological condition that exists in this present case, although, of course, much more pro-

nounced. More important still, it shows an acute absorptive and atrophic process dependent upon nerve lesion; it is, in short, a trophic change, and this I believe to be the direct cause of non-union of bone. If we will review this whole question of non-union and all the causes ascribed to it, no one cause is less open to criticism than the lesion of those nerves which maintain the tissues in their normal state or repair them when injured. Certainly the theory of insufficient blood-supply, so much dwelt upon, falls very far short of explaining the matter. Norris claims that Guéretin's theory of the relationship between the nutrient artery and the seat of fracture has not been proved, and this conclusion is shared by Hamilton. In the case which I have quoted there was a good blood-supply, but a blood current which was only too active in washing away the products of decomposition, a blood current that breaks down rather than builds up. If the nerves which control nutrition break down, the blood in itself is powerless to build up. And this would seem to explain the numerous instances where firm union follows fractures under the most unfavorable conditions apparently. While here and there you see reported cases of non-union ascribed to syphilis, old age, pregnancy and nursing, cancer, fragilitas ossium, scurvy, rickets, general malnutrition, and what not, a large majority of the cases of fracture, even under these unfavorable conditions, unite quickly, and if one will note how small the percentage of cases of non-union really is, the conclusion is inevitable that a nerve lesion is the direct and principal cause, back of which it is impossible to get. In many cases, apparently hopeless, nature can easily establish a collateral circulation, but she cannot establish a collateral nerve-supply; nerve lines are definitely settled.

There is much to be learned on this subject, and it is one which offers an opportunity for original research, and whose difficulties should be rather an incentive for working it out.

REPORT OF A CASE OF CERVICAL RIB, WITH  
REMARKS ON MISTAKEN SKIAGRAPHI-  
CAL DIAGNOSES.<sup>1</sup>

By HOWARD J. WILLIAMS, M.D.,

OF MACON, GA.,

SURGEON TO THE MACON HOSPITAL; LECTURER ON MEDICO-LEGAL  
JURISPRUDENCE, MERCER UNIVERSITY.

THE comparative newness of skiagraphy in surgical diagnosis and the infrequency of supernumerary ribs in the cervical region is, I have thought, sufficient excuse for reporting the following case:

At a recent meeting of the American Academy of Railway Surgeons, at Chicago, in the discussion of a paper on "The Medico-Legal Aspect of Skiagraphy or the X-Ray in Court," I took occasion to disparage the value of the method, not only in legal medicine but also as a surgical diagnostic aid. I related two cases of nerve and functional injury following bone traumatism, in which I was misled by the apparent bone lesion shown by the radiograph, but which, on operating, I found to be a more extensive destruction of nerve and muscle than could be accounted for by the lesions of bone actually present. One of the cases, I learned afterwards, would have resulted in a malpractice suit, the action to have been based on the disclosures of the skiagraph, had not an operation been performed, and the nerve lesion found to be the result of the original traumatism, and not caused by the supposed bad treatment of a reputable medical gentleman.

In the case I now report, the deception of skiagraphy

<sup>1</sup> Read before the Georgia State Medical Society, April 21, 1898.

was of a different form, but equally as misleading. A bony tumor was obscurely shown in the photograph, in a region where it could be felt on the exposed surface of the patient's neck, but its shape and position distorted, as we supposed, by the direction in which the rays traversed the body. The real object for which we were seeking was also shown, but overlooked or accounted for as a normal rib displaced by the angle of entrance of the Röntgen rays. Skiagraphy, I find, is a valuable but not an infallible diagnostic aid, one which the young surgeon and those who have not frequent opportunities of trying should doubt rather than trust. Errors of diagnosis, based upon the findings of the method, will continue to weaken its testimony surgically, and should exclude it legally, until a better understanding of the discovery is reached by a familiar study of skiagraphic tracings compared with post-operative or post-mortem findings in bone and other tissues.

CASE.—Miss R. S., aged seventeen years, white, in the summer of 1896 noticed that the lower left edge of her collar pressed heavily against some hard substance in the base of her neck, and that her clothing would wear out at this point earlier than elsewhere. There was, however, no pain, nor any discomfort in the left upper extremity. On palpation, I found deep in the posterior half of the posterior triangular space of the neck a slightly projecting, painless mass, having the consistence of bone, occupying a plane below the level of the clavicle, which was not adherent to the skin and could not be seen with the eye. Examination of the axillary space disclosed nothing corresponding with the mass above. Movement of the clavicle and scapula was unattended by motion of the growth; on exaggerated respiratory effort it would rise and fall with the rest of the thorax. There was no tenderness on manipulation, nor any interference with the subclavian vessels and other tissues of the region.

I decided it was either a prominent transverse process of a cervical vertebra, an exostosis, or a chondroma springing from the first rib. She was directed to watch it carefully during the next few months, and if it grew rapidly or changed in any way to report.

Early in the spring of 1897 she returned, and I found that it had increased in size and projected higher in the neck. It was about the size of a pigeon's egg, was painless, gave no discomfort, still non-adherent, and unattended by any local discoloration. During the meeting of the medical association of Georgia in our city, in April, she kindly allowed Dr. Samuel Lloyd, of New York City, to take a skiagraph of the region involved, before the members of the association.

A twenty minutes' exposure developed the accompanying radiograph. (Plate I.) The plate was bandaged to the back of the neck and shoulder, not horizontally, but with the left edge considerably elevated above the right. (To see the radiograph correctly, hold it so as to bring the clavicle nearly horizontal.) The cathodal rays then passed through her body antero-posteriorly at an angle of about 40 degrees from above downward and from right to left. The very dark spot to the right of the centre of the skiagraph is a collar-button worn in front, the pointed line above it is a long pin worn in her hair at the back of the neck, the coracoid process of the scapula is seen to the extreme left. The supposed tumor is obscurely outlined below and behind the clavicle, between the button and the coracoid process. It is egg-shaped and occupies a plane apparently below the line of the clavicle and supposed first ribs. This was considered a deception of skiagraphy, explained by the direction taken by the rays in passing through the neck. The growth, as we have seen, really occupied a plane parallel with the clavicle above the first rib, and was disk-shaped, flattened vertically, and antero-posteriorly.

Upon the evidence of the radiograph, the physical character of the growth, and the attendant symptoms, we made a diagnosis of osteoma of the first rib. The line of treatment to be expectant, —wait for signs and symptoms of interference with important structures and functions. Should an operation become necessary, the clavicle should be divided and the growth removed through this route.

November 30, 1897, she came back complaining of pain in the arm, occasional numbness in the hand, and some slight interference with the circulation. The growth had advanced materially in size, and could be seen as well as felt projecting half an inch above the general surface of the base of the neck.

December 15, assisted by Dr. McHatton, Dr. Garrard, and

Dr. Weaver, the latter administering ether, I operated. An incision two and a half inches long was made from the middle of the neck down to the clavicle, midway between the sterno-cleido-mastoid and the trapezius muscles, parallel to and a quarter of an inch behind the external jugular vein. The tissues were dissected down to the growth, the transversalis colli and suprascapular arteries being tied and cut, while all nerve filaments were pushed aside as they were exposed. The normal triangles of this region were distorted by the growth, the omo-hyoid muscles being displaced downward below the plane of the clavicle, the suprascapular and transversalis colli being above the posterior belly of the omo-hyoid, the cervical and brachial plexuses pushed into a position posterior to the tumor.

On reaching the upper edge of the growth, instead of finding it encapsulated, the usual conditions found in chondroma or exostosis, I found a muscle adherent to its apex, the fibres of which were directed upward and backward to the spinal columns. The clavicular and outer surfaces of the growth were exposed by careful dry dissection down to the first rib, to the upper surface of which it was attached by a broad, bony base, just posteriorly to the point where the subclavian artery crosses the rib, in fact the artery rested against the anterior edge of the growth, and was exposed in the dissection. Dissecting backward, I found the tumor also attached by a narrow pedicle to the spinal column. Detaching the muscle from the apex and dissecting down the inner or tracheal side of the growth, the pleura was separated down to the first rib. These dissections disclosed the fact that a complete arch of bone was found reaching from the subclavian notch on the first rib upward and backward to the body of a cervical vertebra. Instead of an osteoma we had a supernumerary rib. From the under or concave edge of this rib to the upper surface of the first rib muscular fibres passed, corresponding to the intercostal muscles. The bone was isolated from this muscle and cut with bone forceps first near the vertebra and then towards the first rib; one and a half inches of bone were thus removed *en masse*, the remaining portions detached by repeated use of the forceps.

Altogether the rib was about three inches long. The vertebral end was one-fourth of an inch in diameter; the costal end about one-half an inch where it was inserted in the first rib; the



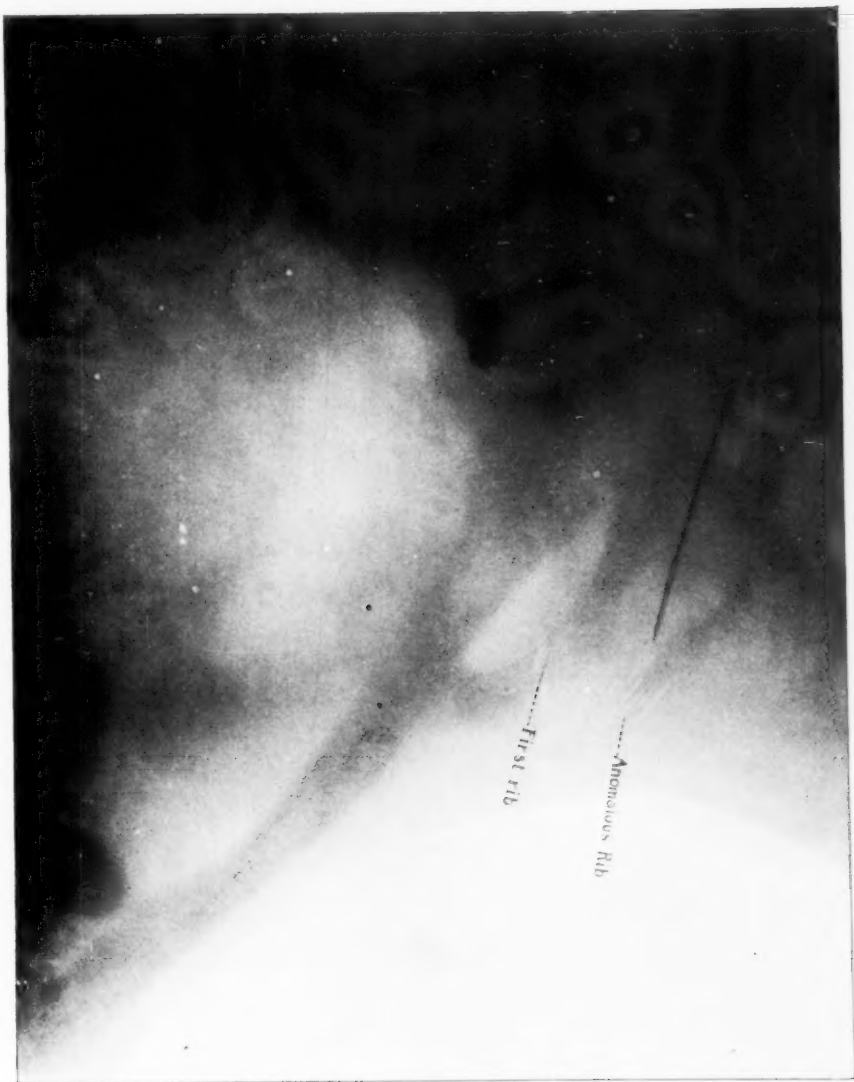


PLATE I.—Dr. Williams's case of cervical rib.

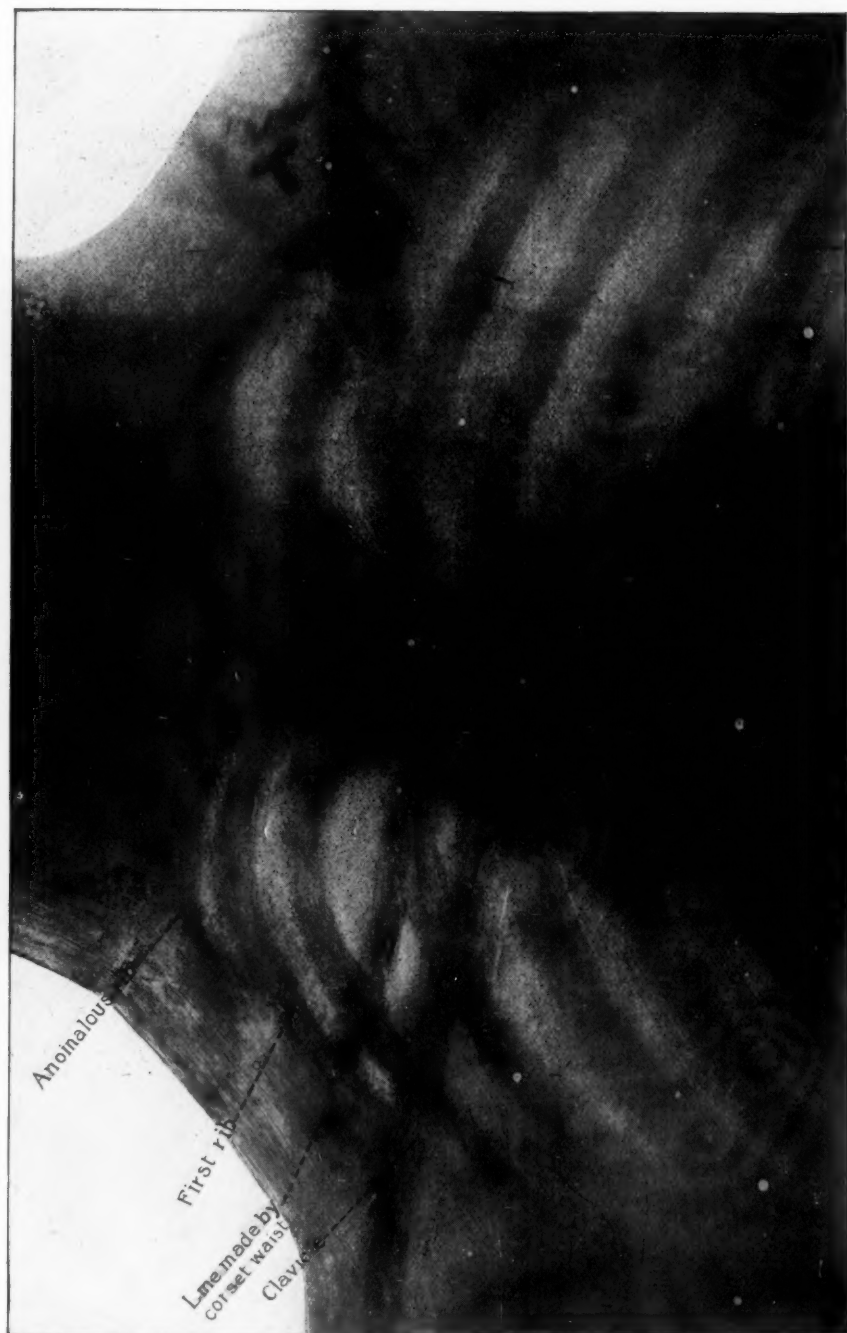


PLATE II.—Dr. Lloyd's case of cervical rib.

later bone was very much expanded where it received the anomalous rib. The growth, like other bones, was composed of an outer or compact layer covered with periosteum, and an inner or cancellous tissue. In the middle of the section removed a joint existed, which allowed, through ligamentous union, a limited motion. The posterior portion of the new rib was, perhaps, an elongated transverse process of a vertebra. From the length and direction of curve of the bone I judge it was attached to fifth or sixth cervical vertebra, most likely the sixth.

Like the first rib, it was unattended by an intercostal artery. The muscle attached to the apex of the rib was either the entire middle scalenus or a large part of that muscle, the point of attachment of the rudimentary rib to the first rib and its relation to the subclavian artery would suggest this conclusion. The anatomical relations of importance were: in front, the subclavian artery, the subclavian vein, and phrenic nerve were not exposed by the dissection; to the outside the transversalis colli and supra-scapular arteries, and the brachial plexus; behind, the lower cervical nerves coming from the spinal cord; and to the inner side, the pleura.

Going back to the skiagraph, the first arch, the one approached by the point of the pin, is the supernumerary rib, clearly defined as it comes from the vertebral column and dips down to the first rib seen below. The egg-shaped spot behind and below the clavicle, which we had supposed to be the osteoma, is now clearly seen, by the discoveries of the operation, to be the expanded costal end of the first rib receiving the attachment of the anomaly. Again, the ligamentous joint is well defined by the interruption in the rib's shadow to the left of the pin. The body of the seventh cervical vertebra, I think, is defined as the dark spot above the centre of the pin. The end of the anomalous rib is seen approaching the column above, and to the left of the dark spot of the seventh vertebra; unfortunately, the radiograph is too indistinct to show the body of the sixth vertebra, to which the rib is attached. Could we have excluded the deception caused by the angle of entrance of the X-ray, and

recognized the possibility of a rudimentary rib, how clear would our diagnosis have been before the operation.

The girl being in the adolescent years of life, it would be impossible to say to what extent this rib might have grown if allowed to remain. Anomalies have no definite extent of development; pressure upon important organs and tissues frequently attend their growth, it is, therefore, good surgery to remove them as soon as symptoms of interference with important functions arise.

In looking up the literature of the anomalous ribs, I find that Quain describes an occasional supernumerary rib which springs from the body and transverse process of the seventh cervical outside of a vertebrarterial foramen. This is, however, a false rib, having no distal attachment, like the last or floating ribs of the thorax. I cannot, in the books to which I have access, find any description of a supernumerary rib corresponding to the one I present,—that is, a rudimentary rib springing from the sixth cervical vertebra, with a single attachment, a complete arch, and a bony insertion on the first rib.

Since writing the above, I learn by letter from Dr. Lloyd that Dr. Bull, of New York, showed a few days ago an anomalous cervical rib to his class, but no description accompanied Dr. Lloyd's information.

The patient pursued the usual normal course after aseptic operations, had primary union, and is restored to health without pain or interference with the proper functions of the parts involved.

#### NOTE ON DR. WILLIAMS'S PAPER.

By SAMUEL LLOYD, M.D.,

OF NEW YORK.

SINCE I took the skiagraph of the case reported above by Dr. Williams, I have had an opportunity, through the courtesy of Dr. F. A. Goodwin, of New York, of making the

accompanying radiograph (Plate II) of another case of cervical rib. This case was a girl, about twelve years of age, who, like the one reported by Dr. Williams, was having pain from the pressure of her collar on the projecting portion of the rib. Apparently this rib arises from the seventh instead of the sixth cervical vertebra, and is attached, as in the other case, to the first rib. It made a projection in the neck, and was slightly painful on pressure.

The distortion in the picture of Dr. Williams's case was due to the position of the patient. This picture was taken as a demonstration of the method of making a radiograph before the Georgia State Medical Society, at Macon, in 1897, and the plate was bandaged to the neck while the patient was sitting in front of the tube. Of course, the plate tilted more or less, so that it was not in close contact with the neck, and the resulting picture was the shadow of the bones thrown on the plate. Both of these pictures were presented to the Georgia State Medical Society, at Cumberland Island, this year. In the discussion I felt called upon to make the following comment on Dr. Williams's criticism of the X-ray in medico-legal cases:

"The use of the X-ray in medico-legal cases, without careful preparation for that work, would do great harm. To leave a photograph that has to go into court to a single individual who may be interested in the case would be a grave error, for he might accentuate the deformity very decidedly by placing the tube a little out of its proper position; and consequently in every case that has to appear in court an X-ray picture should be taken before witnesses, who can swear to the position of the photographic plate, the position of the patient on this plate, and the position of the tube, and who can at the same time swear to the distance at which the tube was placed from the patient, so that allowance may be made for any distortion that may appear in the picture, and as far as possible to avoid distortion."

## TRANSACTIONS OF THE NEW YORK SURGICAL SOCIETY.

*Stated Meeting, April 11, 1898.*

The President, ANDREW J. McCOSH, M.D., in the Chair.

### THE CLOSURE OF SINUSES AND ABSCESES IN TUBERCULAR BONE LESIONS.

DR. V. P. GIBNEY presented a girl, aged eleven years, who was operated upon, April 15, 1898, for a tuberculous focus in the head of the tibia, presenting an abscess extending around the inner side of the knee above the internal condyle. There was more or less deformity, without marked spasm, however, the signs being those of a periarthrititis. An incision was made over the inner side of the tibia down to the inner point of insertion of the ligamentum patellæ; about a tablespoonful of broken-down bone was removed with the curette, and a counter-opening made on the inner side of the thigh. Into this opening a small tent was inserted, which was removed on the second day. The anterior wound was then closed. The limb was encased in plaster of Paris for three weeks, when all kinds of apparatus were discarded. The patient made a speedy recovery, and now has perfect use of the limb.

Dr. Gibney also presented a boy of fifteen, who had been brought to the hospital many years ago with a tuberculous knee-joint, for which he was treated by operation. He made a very good recovery and was lost sight of for a number of years. Recently he again appeared with a relapse: there was complete luxation backward of the head of the tibia, forming an immense sulcus just above the popliteal space. The head of the fibula was very prominent and was overlapped by the femur. Excision of the joint was resorted to with an excellent result. At present the limb is quite straight and there is a faint trace of motion.

Dr. Gibney presented a third patient, also a boy, upon whom he had performed excision of the knee-joint for tuberculous disease. Healing was prompt and uneventful. It is needless to say that this patient was too old for mechanical treatment, especially

as the disease had advanced to the involvement of the lower end of the femur and upper end of the tibia. Indeed, apparatus had failed in the earlier stages, the intelligent care being wanting.

#### SUPRAMALLEOLAR OSTEOTOMY FOR OBSTINATE CLUB-FOOT.

DR. GIBNEY presented a boy who, in December, 1895, had come to this city from the West for the relief of extreme club-foot. In January, 1896, Phelps's operation was performed, but as this failed to permit complete flexion of the foot, he made an incision over the head of the astragalus and removed a small portion of it. After this the foot came into very good position. The wound healed promptly, and in the course of a few months the boy was sent home wearing proper shoes and an apparatus to avoid a relapse. In the winter of 1896 it was noticed that the foot had again become distorted. The boy returned to New York, and an attempt was made to correct the deformity with a wrench; this did little good, and was very painful. Then plaster-of-Paris bandages, frequently renewed, were tried, together with a board on the sole of the foot, but still the foot would roll to the outer side. Three weeks ago Dr. Gibney did a supramalleolar osteotomy, dividing the tibia and fibula. The speaker said he had obtained permanent results from this operation in a number of cases of obstinate club-foot, which are rendered so difficult to cure by the changes that occur in the articular facets during the growing stage.

#### THE REMOVAL OF BILIARY CALCULI FROM THE COMMON DUCT BY THE DUODENAL ROUTE.

DR. CHARLES MCBURNEY read a paper with this title, for which see page 481.

DR. CHARLES K. BRIDGON said the profession was indebted to Dr. McBurney for this operation, as it afforded the surgeon a method of attacking gall-stones in a region which was formerly regarded as practically inaccessible. In many such cases, hitherto, the operation had been desisted from on account of the opinion that existed that the stone was beyond the reach of the operator. While in the large majority of instances a calculus in the common duct could be removed through a vertical incision into the duct, the speaker said he agreed with Dr. McBurney that

in the exceptional cases the operation could be better done through the duodenum, providing the operator was conversant with the details of the operation; for most general surgeons the incision of the duodenum might prove difficult.

Dr. Briddon said that in a number of instances where he had removed a stone from the common duct through a vertical incision in the duct the patients did well. In those cases where the calculus was large and the duct dilated the latter could be readily sutured, but this was very difficult in those instances where the calculus was small. Dr. McBurney's operation, he thought, was particularly applicable to those cases where the calculus had become firmly impacted by its efforts to escape into the intestine; whether the method was preferable in all cases, whether the calculus was large or small, impacted or not, the speaker said he was not prepared to say.

Dr. Briddon also said that he thought delivery of the stone through the intestine should be restricted to cases in which it could not be successfully attacked through the duct, as the former was an unnecessary complication of the latter operation.

DR. ROBERT F. WEIR said he could recall two cases of calculus in this comparatively inaccessible portion of the common duct, and one of cancer of the papilla, where he would have resorted to this method of operation had it been satisfactorily known to him at the time. While in some cases a stone low down in the common duct can be removed through an opening from above, which, if necessary, may be permitted to close without suturing, there are other cases where the calculus is situated so near the intestine and so tightly fixed that it can only be reached with great difficulty excepting through the duodenum, as described by Dr. McBurney.

DR. FRED. KAMMERER said he was much interested in the statement made by Dr. McBurney that it was rather easy to find the opening of the common duct in the duodenum of the living. The speaker said he had occasionally found it difficult to locate the outlet of this duct in post-mortem examinations. Dr. Kammerer said he would feel strongly inclined to resort to this method of operation in suitable cases, as he knew from experience how difficult it was to remove an impacted calculus in the farthest portion of the common duct, especially when adhesions were present. From a theoretical point of view it certainly did



seem more rational to attack an impacted calculus, lying in the duodenal portion of the common duct, from the duodenum itself. Such a course might save the trouble of working one's way down to the stone through many firm adhesions or by a much altered cystic and common duct.

DR. B. FARQUHAR CURTIS said that about eighteen months ago he had had under his observation a patient with obstruction of the common duct, of several months' standing, due to a tumor of the papilla. Owing to the age of the patient and the concomitant gastric symptoms it was supposed that the growth of the papilla was malignant in nature. The gall-bladder was exposed by a vertical incision through the rectus muscle, and was found to be very much elongated, reaching below the umbilicus; its diameter, however, was not much increased. The common duct was also greatly dilated. A small, hard mass was felt in the wall of the duodenum, and on incising the latter and exposing the papilla, a tumor, about as large as a French pea, was found involving about one-half the circumference of the duct. A small portion of this was excised and submitted to a pathologist, who pronounced it to be an adenoma. The orifice of the duct was slit up on the side away from the tumor and the intestinal wound sutured. The patient made a good recovery, but one year later the symptoms recurred. The abdomen was reopened and a Murphy button inserted between the end of the elongated gall-bladder and the small intestine. Since then the patient had had no further symptoms.

DR. A. J. McCOSH said he thought all surgeons would agree in commending the value of Dr. McBurney's method in certain cases. In the last case coming under his observation, where the stone was situated low down in the common duct, the speaker said he had experienced great difficulty in extracting it from above, and he found it impossible to suture the incision in the duct afterwards, as its walls were so softened that the sutures tore out as soon as inserted. He regretted at the time that he had not employed the method advocated by Dr. McBurney.

#### EXCISION OF THE RECTUM, WITH SECONDARY INTESTINAL ANASTOMOSIS.

DR. A. J. McCOSH presented a married woman, thirty-six years of age, who gave the following history: In August, 1890,

she was operated on for a perityphlitic abscess, and subsequent to that operation she had never been entirely well, having suffered very much from pain in the lower part of the abdomen. From 1890 to 1896 she had eight miscarriages, and was curetted nine times. During 1896 her pain became worse; it was often colicky in character and accompanied by nausea and frequent vomiting. There was obstinate constipation. Three months prior to her operation she had been curetted, and since then had practically been confined to bed until she was brought to the hospital, on May 7, 1896. During these three months she had suffered severely,—the bowels had been moved with great difficulty, the abdominal cramps were severe, and the vomiting persistent. Her stools had been at times bloody. Her temperature, on her admission to the hospital, was 104.5° F.; pulse, 125 per minute.

On opening the abdomen a mass was found behind and to the left of the uterus, filling the left side of the pelvis; it was hard and nodular, and through it passed the lower part of the sigmoid and the upper part of the rectum. On separating the adherent intestines from this mass two or three small abscesses were opened. The upper three inches of the rectum and the lower two inches of the sigmoid were so tightly embedded in the tumor, and seemed to form such a component part of it, that it was suspected that the tumor was a malignant growth of the bowel. For diagnostic purposes the sigmoid flexure was opened just above the tumor, and for a space of four inches the calibre of the bowel was found to be almost obliterated. The index-finger could not be passed through the stricture. An excision of the mass, which included about six inches of the large bowel, was carried out, and this removed the lower inch or two of the sigmoid and the upper three or four inches of the rectum. The rectum was closed by a large clamp at a point about four inches above the anus; the divided end of the sigmoid was fastened in the abdominal wound, thus making an artificial anus. The patient's condition was such that an anastomosis could not be done. Active stimulation was needed towards the close of the operation. A tube inserted through the anus was left in the lower rectum.

The patient made a slow recovery, but after leaving the hospital she gained flesh and strength very rapidly, so that in January, 1897, she had gained forty pounds in weight. She was

not content, however, with her artificial anus, in spite of the fact that there was no leakage excepting when the bowels were loose. She insisted on the closure of the artificial anus, and this could only be done by uniting the end of the sigmoid to the rectal fragment which had been left. Accordingly, in January, 1897, by an elliptical incision the end of the sigmoid was excised from the abdominal wall and the descending colon loosened as freely as possible. This was very difficult, because of the dense and numerous adhesions. A sacral wound was then made and the lower segment of the rectum found: it had become considerably contracted. By passing one hand and forearm through the sacral opening and the other through the abdominal wound approximation between the two severed ends of the gut was secured. A lateral anastomosis was done, as the introduction of a Murphy button was deemed inexpedient. There was slight leakage after the operation, but this gradually ceased, and the patient made an uneventful recovery.

The operation was done about a year and one-quarter ago. The patient has gained about 100 pounds since she first came under observation. The pathologist reported that the tumor removed showed simple inflammation.

DR. KAMMERER said that in two instances, coming under his observation, colostomy had been done by other surgeons to relieve symptoms of constriction, which were the result of inflammatory processes in the female, originating in the generative organs and spreading to the perirectal tissues. In one of those cases he had subsequently succeeded in closing the inguinal anus by resection. The speaker suggested that in a case like the one shown by Dr. McCosh, unless the adhesions were very dense and of long standing, a colostomy, followed later by resection, was less severe and might also lead to a favorable result.

#### STENOSIS OF THE LARYNX FOLLOWING REMOVAL OF PAPILLOMA; OPERATION BY THE "STRING METHOD."

DR. ROBERT ABBE presented a young woman who for five years had suffered from laryngeal obstruction due to papilloma. The obstruction gradually became so pronounced that the growths were removed, by Dr. Barton, by the intralaryngeal method: they rapidly recurred, however, and two subsequent operations of a similar nature were performed.

After the third recurrence it was found that the papillomatous masses were beyond the reach of intralaryngeal measures. Accordingly, a low tracheotomy was done by Dr. Abbe, and then the thyroid cartilage was opened by a zigzag incision, in order to prevent vertical sliding. When healing, it was found necessary to remove the anterior portion of each vocal cord, as both were studded with these papillomatous growths. Below the cords was a bulging mass of papillomatous tissue, which was also removed. The base of the growths was then cauterized with the Paquelin, which measure, Dr. Abbe said, he wished to try, because the use of monochloroacetic, chromic, and carbolic acids, and other applications, had failed to prevent recurrence. Perfect closure of the wound in the larynx was secured by transfixing that structure with a double silkworm-gut suture, tied over a roll of gauze, outside the skin, on each side. The tracheal tube was left in four days. The patient made an excellent recovery, but three months later there was a recurrence of the laryngeal stenosis, with marked stridulous breathing. On examination, the larynx was found stenosed by cicatrix, without papillomata, to such a degree that no instrument could be introduced from above. The trachea was thereupon again opened, and a No. 24 French bougie à boule passed up, after a number of smaller sizes had been introduced. Then a conical metal bougie was introduced and pressed tightly into the stricture, while a heavy braided silk, previously passed from mouth to tracheal wound, was seesawed back and forth, thus cutting quickly and bloodlessly the dense stricture. The obstruction was thus gradually enlarged until, finally, a bougie that filled the trachea was passed through. Subsequently the larynx was dilated from above with a large œsophageal bougie, and since then Dr. Barton had prevented a recurrence of the stenosis by the introduction of extra large O'Dwyer tubes, which the patient wears for a few hours each day.

DR. MCBURNEY said that in cases of this character, where the larynx contains papillomatous masses which cannot be reached through the mouth, a subhyoid pharyngotomy is a very satisfactory method of approach. The operation is done by making a transverse two-inch incision through the integument and other soft parts down to the thyroid-hyoid membrane. This membrane is incised just at its upper edge, beneath the hyoid bone, and so the pharynx is opened just above and on either

side of the epiglottis. The incision is to be then widely opened with retractors, and the epiglottis drawn well out of the wound by means of a ligature passed through its tip. The vocal cords and the interior of the larynx are now freely exposed, and growths can be readily and perfectly removed. Dr. McBurney said that he had made use of this operation with great satisfaction.

DR. ABBE said this was the first time he had used a string for the purpose of dividing a laryngeal stricture, although he had already resorted to this method in the œsophagus. The string he employed was, of course, braided silk. The sawing is only done while the tissues are being stretched by the bougie.

#### CARCINOMA OF THE RECTUM.

DR. FRED. KAMMERER presented a man, of about forty-five years, who had come under observation three years before with a carcinoma of the rectum, when Dr. Kammerer did an osteoplastic resection, excising about five inches of the rectum and numerous infiltrated glands in the sacral region. The patient was in very poor condition at the time, and the operation had to be hurried on account of collapse, which necessitated an intravenous transfusion. The two ends of the gut were hastily united and the divided bones approximated. A few days later there was leakage of fecal matter from the wound, evidently confined to the sutures in the posterior part of the rectal wall, and as a result of this, the skin sutures, which had been inserted to approximate the osteoplastic flap, separated, and the entire flap became loose. In the course of five or six weeks the fistula healed, and the osteoplastic flap assumed a very respectable appearance.

Dr. Kammerer said that an interesting point in connection with the case was that, in spite of the fact that many of the glands were infiltrated, no recurrence was appreciable after three years. It was, therefore, probable, he thought, that the enlargement of the glands was due to ulceration of the neoplasm rather than to metastatic deposits in the glands themselves.

#### HOW TO PREVENT THE DANGERS AND DISAGREEABLE EFFECTS OF ETHER.

DR. RUSHMORE read a paper with the above title, for which see page 472.

DR. B. F. CURTIS indorsed the remarks of Dr. Rushmore favoring the administration of ether by one of the regular hospital staff rather than by a special anæsthetist. If the new men are properly instructed in this work, there is not much liability to danger. Furthermore, Dr. Curtis expressed the opinion that the administration of an anæsthetic—ether, chloroform, or nitrous oxide gas—was not complicated or difficult enough to require the entire services of one man. In most of the cases, where death has occurred from the administration of ether, it has resulted from carelessness, and might have been avoided by proper precautions.

DR. MCBURNEY said he thought the subject of the proper administration of ether a most important one. He knew of few men who gave ether well. While every one, of course, appreciated the importance of giving a house-staff opportunities to administer ether, it was also very desirable to have them *properly* instructed. Many men, in spite of ample practice, never learn to give ether well, while others learn the art very quickly. Very few medical men administer ether well.

Dr. McBurney agreed with Dr. Rushmore that the hypodermic administration of morphia and atropia previous to an operation was of advantage. Heretofore, the speaker said, he had only resorted to this in cases where he anticipated a good deal of restlessness or wound-pain, and he had become impressed with its value.

The condition of the patient's stomach—whether empty or full—was another important consideration. Its condition does not depend alone on the length of time intervening between the last meal and the time of operation, but also on the activity of the organ. In some patients the stomach may empty itself within six hours after a meal; in others, not in twenty-four hours. It might be worth while almost uniformly to introduce the stomach-tube and wash out the stomach after the patient reaches the operating table. The speaker said he had resorted to this expedient in certain cases where he expected to operate on the stomach itself or on the intestine just below the stomach.

DR. ROBERT ABBE said that in his hospital work he had uniformly adopted the practice of first administering laughing-gas and then ether, and he had found that this method possesses many advantages. The patient goes under the influence of the

gas immediately, and then the ether is administered without any struggling. The anæsthetization is done by the house-staff. Very little of the gas is necessary, and less ether than by the ordinary method is required, particularly if an injection of morphine is first given. A moderate dose of morphine is preferable to a large one; otherwise the breathing is very apt to become quite shallow.

DR. ALEXANDER B. JOHNSON said that several months ago he had adopted the plan of giving nitrous oxide gas previous to the ether in the Out-Door Department at Roosevelt Hospital, and he had noticed that one advantage of the method was that the patients recovered much sooner from the effects of the ether. In order to avoid struggling during the first stage of etherization, it was important that the room should be absolutely quiet; furthermore, the patient's confidence may be gained by placing the ether-cone in his hands and instructing him to take a few deep breaths. If this is done—unless he be an alcoholic—he will usually go under its influence with scarcely any struggling.

In the resuscitation of patients who are threatened with collapse from the effects of ether, the application to the chest of a towel wrung out in water hot enough to blister the skin was a very valuable procedure.

DR. C. L. GIBSON said that for several years he had kept careful notes of cases where atropine was administered prior to the operation, and in studying the results of this treatment in a series of over 100 cases he had satisfied himself that while the atropine did not prevent vomiting subsequent to the administration of ether, it did lessen the bronchorrhœa, and acted as an efficient stimulant.

When morphine is administered, the patients are anæsthetized more quickly, but the breathing often becomes alarmingly shallow.

#### REMOVAL OF BILIARY CALCULI BY THE DUODENAL ROUTE.

DR. MCBURNEY exhibited biliary calculi which he had removed from a woman who for nine years had suffered from jaundice and pain and tenderness in the region of the gall-bladder and common duct. On entering the peritoneal cavity he found the gall-bladder slightly distended; he opened the gall-bladder

and removed two calculi and pushed up two smaller ones which were in the cystic duct. The common duct was also filled with a mass of elongated calculi throughout nearly its entire length.

In removing these calculi from the common duct the operation by the duodenal route was selected. The lower end of the common duct was readily found and dilated, the calculi were removed without difficulty, and the intestinal wound was at once sutured. The whole abdominal wound closed with great rapidity. Five weeks after operation an attack of pain, which lasted a few hours and was accompanied by jaundice, occurred. Since that time, nearly a year, the patient has been in perfect health. This last short disturbance was doubtless due to the passage of some small fragment which had been overlooked at the time of operation.



TRANSACTIONS OF THE SECTION ON GEN-  
ERAL SURGERY OF THE COLLEGE  
OF PHYSICIANS OF PHILA-  
DELPHIA.

*Stated Meeting, March 11, 1898.*

JOHN ASHHURST, JR., M.D., in the Chair.

THE CAUSE AND MECHANICAL TREATMENT OF  
DISLOCATIONS OF THE SEMILUNAR CAR-  
TILAGES OF THE KNEE-JOINT.

DR. NEWTON M. SHAFFER read a paper upon the above sub-  
ject, for which see page 417.

DR. REGINALD SAYRE said that he had seen very few of these dislocated semilunar cartilages, although he had seen various cases of loose bodies in the knee-joint which gave very similar phenomena. In those cases that he had seen it had been possible, by manipulating the joint, to slip the cartilage apparently back to its normal position or, at any rate, near enough approximation of its normal position to allow the joint to resume its normal function. He had also found it necessary to limit the motion of the joint for some time in the lateral direction, using an apparatus almost identical with that shown by Dr. Shaffer, which he had found very useful in cases of slipping patella as well. He had noticed that various gentlemen had reported cases of dislocated semilunar cartilages, where it seemed not so easy to replace them as in the cases that have come under his observation, and he could imagine, in some cases, the violence which causes this displacement, and which may have been so serious as to rupture the coronary ligament, so that the patient would always be compelled to wear an apparatus which would limit motion of the joint and protect him, and that these patients would never obtain the complete function of the joint. In some cases which he had

seen it had seemed to him that the application of the cautery tended to improve the stability of the joint materially, and that after deep and severe cauterization the coronary ligaments were much stronger; at any rate, the function of the joint was very much better, which he attributed to the control exercised over the semilunar cartilage by the coronary ligaments, so that they were not allowed to slip as much as before. In manipulating the knee in displaced cartilage he had found it necessary, when the joint was extended, in addition to making traction in the long axis of the tibia, to make traction from behind forward to overcome the posterior luxation, which occurs to a slight extent in these cases, similar to the posterior luxation, which occurs in chronic disease of the knee-joint. After manipulating these knees with traction from behind forward upon the head of the tibia, he had often found that they had great relief from the pain which they had experienced previously in making movements of the joints, and it seemed by slipping the head of the tibia forward on the condyles of the femur that the normal relation of the interior of the knee was restored, and the cartilage was kept from being pinched as it was previously. In the few cases he had had the twisting of the body, or turning on the heel, had been a quite frequent source of re-exciting the disability; and patients had usually complained that some trivial accident which occurred while their muscles were relaxed had been more the cause of trouble than more severe exercise, while their muscles were under the control of their will and in a state of tension. He had one patient, a professional dancer, who, while suffering from this disability, was enabled to go through a quite complicated dance, while his muscles were tense; several times he had relapses on turning over on an easy-chair, when the muscles were in a state of relaxation. He said he felt perfectly secure and safe as long as he was on guard and held his muscles perfectly rigid. Acting on that line, Dr. Sayre had in these cases invigorated the muscles as far as possible by massage and graduated exercises, and had found that the patients appear to have much better control of the knee when the muscular strength of the thigh was improved.

DR. WISNER R. TOWNSEND said, with regard to the relaxation of the ligamentum patellæ as one of the causes of production of the trouble under consideration, that observations upon this point would be of extreme value when it came to a question as to

whether a surgeon should continue to treat a case mechanically that has suffered from this disability or whether resort should be had to operative interference. If, after treatment, the ligament shortens, it may be concluded that it will hold the knee in such position as to prevent a dislocation, and the patient may be allowed to leave off apparatus and go about.

If, after treatment, the ligament remains still too long, the dislocation may be expected to recur, and in that case the question of surgical interference and operation must be considered. Among the operative procedures possible he mentioned shortening of the unduly relaxed ligament, first by actually shortening the tendon itself, and, second, by lowering the tubercle to which it is attached.

It had been his fortune to see, in the service of Dr. Gibney, quite a number of these cases, and to have seen four cases in his own practice. They had all been relieved by apparatus similar to that shown. He had met only one case where he could feel the dislocated cartilage. By proper manipulation he seemed to be able to perfectly reduce it, and the limb was rendered normal so far as mobility and motion were concerned.

A correct diagnosis in these cases is not always easy, and in many obscure cases, where one cannot find out exactly what the trouble is, it is concluded that it must be dislocation of the semilunar cartilages. He knew that this had been the case in several patients he had seen, in which there was a history of sudden pain in the knee, with uncertainty as to whether it occurred in flexion or extension. It is not as severe a pain when there is a foreign body present, but the pain will be sufficiently severe to cause the sufferer to stop walking. On examination of the joint one may find nothing, while in more severe cases synovitis is usually present and the symptoms well marked, and the diagnosis is very clear. He believed that nearly all cases should be submitted to mechanical treatment before they are subjected to operative treatment, and the experience of Dr. Shaffer would lead to the belief that a large proportion so treated can be cured. By mechanical measures are cured nearly all those in which cartilage or ligaments are not torn. How to decide this point is generally very difficult. The value of X-ray work in this line may be demonstrated later, when surgeons are able to get better work and to read their pictures better, for now one sees many skia-

graphs that one does not know just how to interpret. As to the recurrence of the deformity, he recited the case of a young man, about twenty, who stated very clearly that his pain and disability occurred when he put the limb in full extension. It had occurred a number of times, and he was perfectly able to observe the case well, and was a very fair observer. In that case rest for a week or two, without the advice of a surgeon, was sufficient to allay all the symptoms; he would be perfectly well, and at the end of two or three weeks would have a recurrence of the difficulty. He had no effusion, but simply a painful joint. Dr. Townsend was not able to feel the displaced cartilage, and he suggested that he have a straight plaster-of-Paris splint, and wear it a couple of weeks. He did so, but after its removal, at the end of three or four weeks, he had a recurrence. This occurred three or four times, and then he put on a brace similar to the one shown by Dr. Shaffer, which was kept on for a year, and at the end of that time he was well. He had seen him two years after the brace was removed, and he had had no recurrence.

DR. R. TUNSTALL TAYLOR said that he had seen but three cases of this trouble, and each one was a relapse from an accident, which had occurred to the knee some time previously. These cases were suffering from more or less synovitis with effusion into the joint, which rendered palpation difficult and obscure; but the patients complained of a certain amount of pain and grating within the joint when attempts were made at flexion or extension, as though a foreign body were pressing on the articular surfaces. Abnormal lateral mobility was not present in these cases. One case was a man, about sixty years old, who had been shot through the quadriceps extensor cruris in the Civil War, and the wound underwent extensive suppuration, binding down this muscle and allowing but 30 to 45 degrees of flexion at the knee. While ascending a stairway he made a misstep, stumbled, and fell, flexing his leg on the thigh several degrees beyond its accustomed range of motion; this caused severe pain in the joint, and he was unable to extend it immediately. He suffered for some days, but was gradually able to get about, although the joint continued swollen. About two weeks after the accident, patient was again disabled by something acting as an irritant within the joint. Owing to the swelling he was unable to convince himself that the semilunar cartilage was displaced.

Whether the irritant was a fragment of cartilage, bone, fibrin, or calcified bits of synovial fringe, he was unable to say, but after wearing a plaster-of-Paris bandage for a month, in full extension, the irritation disappeared, and did not return. This may be explained either by absorption or by the ligamentum patellæ regaining its tone (as Dr. Shaffer points out), and enabling the joint to "pop" the irritant out beyond the bearing articular surfaces.

The other cases were foot-ball players, whose knee-joints had "locked" after injury in flexion in the typical manner, and both were liable to relapse, unless they wore a rubber Esmarch around the joint, which seemed to afford entire relief, except that the sufferers are unable to participate in any violent exercises.

DR. HENRY LING TAYLOR said that he had often found in obscure affections of the knee, which were evidently not chronic inflammation in the ordinary sense, that it was exceedingly important to prevent lateral motion and rotation, and sometimes to limit antero-posterior mobility. Some of these obscure cases had cleared up after preventing lateral motion. He cited the case of a lady who had consulted several surgeons in regard to her knee, which had been annoying her for some time by pain and disability, which could not easily be explained. At her second visit she herself communicated the cause to him. She had made the discovery that a callosity, which existed under the head of the metatarsal bone of the great toe, had caused her to walk on the outer edge of the foot, thereby subjecting the knee to lateral strain. When the pressure upon this callosity was relieved by scooping a socket in the sole of the shoe to fit it, she was enabled to step squarely on her foot; the knee trouble disappeared without the use of any apparatus whatever.

DR. DE FOREST WILLARD said that the histories which Dr. Shaffer had given and the clinical cases of slipping semilunar cartilages, which most surgeons had encountered, prove most distinctly that not only the ligamentum patellæ but all the structures about the joint are elongated. This condition may be caused by early rickets. Elongated ligaments in early life will later give undue mobility to the joints, with varying conditions of knee deformity, as well as loosening of the semilunar cartilages. The mechanism of hyperflexion, or extreme flexion, by means of which these cartilages are forced forward suddenly from their positions, is well illustrated by the ease with which a

watermelon seed may be propelled by pressure between one's thumb and finger. This mechanism was never so thoroughly impressed upon his mind as when on falling, recently, the whole weight of his body came upon the knee, bending it sharply and forcibly into extreme flexion. There was an instantaneous feeling of absolute disability with a distinct sensation of a crushing force in the posterior part of the knee-joint, which sensation continued for many hours, as though there had been a condensation of the posterior section of the semilunar cartilages. This was followed by intense pain and rapid effusion, in twelve hours the knee-joint being filled with fluid. Had the semilunar cartilages not been anchored firmly in place, or had there been any degeneration or relaxation of ligaments or of *ligamentum patellæ*, the powerful force would have slipped these cartilages from their position.

DR. J. K. YOUNG said that he had usually recommended the apparatus of Howard Marsh, of London, which prevents hyperflexion of the joint; it is made of sheet steel, prevents hyperflexion, hyperextension, and the slipping of the patella. For dislocation of semilunar cartilages it is particularly useful. The term which Hey used, of "internal derangement of the knee-joint," appeared to him to be a particularly bad one. At that time surgeons were in the habit of calling any injury about the knee-joint that they did not understand internal derangement. These included all injuries from simple sprain to suppurative arthritis. The term elongation of the patella is much better. The condition of dislocation of the semilunar cartilages should be divided into two stages, the acute and the later stage. During the acute stage the treatment should be directed to the reduction of the inflammation; in the later stages methods must be used to cause the disappearance of deformity, and Marsh's apparatus is the one which he had used up to this time; but he should take the first opportunity to use the apparatus recommended by Dr. Shaffer.

DR. H. AUGUSTUS WILSON remarked upon the prognosis of these cases: Dr. Shaffer had alluded to the length of time that apparatus, on the principles he had laid down of limiting motion, should be worn. It had been his misfortune to have seen two cases where the slipping had recurred after a prolonged interval; one case, after an interval of three years, where an apparatus somewhat similar to Dr. Shaffer's had been applied, and used for

something like one and a half years, which would seem to be ample time when the joint was in an apparently normal condition; one and a half years later the joint slipped again on some traumatism similar to that producing the first break. After a period of three years there was a relapse. So what is the future of such a joint, if one depends upon apparatus only, or upon operative interference? If the joint can be absolutely limited in its function, so that its original condition of union of the semilunar cartilages to the bones shall be such that it will prevent further displacement and that the elongated patella can be shortened, then there is a possibility of having a future strong joint. The difficulty has been that reliance was placed upon elastic knee-caps and fixed apparatus of rigid character, and the normal functions of the joint have not been stimulated in the manner Dr. Shaffer had laid down.

Dr. JOHN ASHHURST, Jr., said that one point, as to the causation, seemed to admit of question in the argument of Dr. Shaffer, as to the effect of elongation of the ligamentum patellæ and relaxation of the other ligaments of the joint, allowing extreme lateral motion, in producing dislocation of the semilunar cartilages. He could very well understand that these conditions might be a cause of recurrence, but it seemed to him that there was no evidence that they exist before the dislocation first takes place. He knew that elongation of the ligamentum patellæ would result from distention of the knee-joint by synovial effusion under any circumstances; this is constantly seen in cases of hydrarthrosis, where is found a large puffy swelling between the tuberosity of the tibia and the patella, and in very many cases, in children particularly, there is relaxation of the lateral ligaments, allowing extreme lateral motion of the joint, without any change which can be considered morbid. This lateral motion is sometimes so great that he had been told by resident physicians in a hospital that they felt satisfied that a child had a fracture of the knee-joint, because they felt crepitus, when this was simply from the expanded head of the tibia clapping against the condyles of the femur as the joint was moved from side to side. It seemed to him that Dr. Shaffer had not proved that either of these conditions is a necessary precedent to dislocation of a semilunar cartilage, though that they may be causes of a recurrence of the dislocation he was prepared to admit.

In regard to the exact nature of the lesion present in these cases, he thought the term "internal derangement of the knee-joint" a convenient one, because it is not always absolutely certain what is really the pathological condition. He had in a few cases removed a semilunar cartilage by excision, and had believed that there had been actual dislocation of the cartilage, because it presented an indentation which seemed to show that it had been really displaced from its normal position and pinched by the coming together of the femur and tibia; at the same time it ought to be remembered that Sir John Erichsen taught that, while the cartilage was dislocated, the symptoms were due to the pinching of the synovial fringes, and one must remember, too, Mr. Knott's opinion, founded on a careful study of his own case, that the cartilage was not displaced, but that it remained in its normal position, and that it was a jerking or rocking of the femoral condyle over the edge of the cartilage which gave rise to the symptoms. Therefore, while from his own observation he was disposed to believe that the condition is usually a dislocation of the cartilage, he was not prepared to say that it was necessarily so in every instance.

In regard to treatment, of course, he approached the question from the stand-point of the general surgeon rather than of the orthopædist, yet he had always advised the use of mechanical apparatus rather than a resort to operation. There are, however, patients who become dissatisfied with the use of apparatus, and there are others, in the humbler classes of life, to whom the expense of an apparatus is a matter for serious consideration, and he had therefore in three or four cases been induced to resort to operative measures. He had not adopted the suggestion of Anandale, Owen, and other British surgeons, to replace and fix the cartilage by sutures, because it had seemed to him that this, while less certain, would be attended by as much risk as the more radical operation of excising the cartilage itself. The latter method, as practised by Brodhurst and Croft, he had followed in three or four cases, the patients having all recovered with good use of the limb, and having been abundantly satisfied with the result. The plan suggested by Dr. Townsend, that the ligamentum patellæ should be shortened, would appear to be less sure and not less dangerous than excision of the cartilage, and therefore to be less desirable.



In regard to the formation of the so-called loose cartilages or floating bodies in the knee-joint, it is usually maintained that these in almost all cases are the result either of traumatism or of slow exfoliation of portions of the articular cartilage. He had, however, the opportunity of seeing a case which had made him disposed to agree with Sir George Humphry, that these bodies originate in the synovial fringes of the joint. The case to which he referred was that of a patient who had undoubtedly a loose cartilage in his knee-joint. He opened the joint and found this loose cartilage, with a corresponding cavity or indentation in the femoral condyle, and any one looking at it would have certainly thought that it was a portion of the articular surface, but on further examination it was found that this loose cartilage was attached by a distinct filament to the synovial fringe whence it originated, and that the cavity in the condyle was manifestly secondary, resulting from pressure. He was, therefore, disposed to think that at least the majority of the so-called loose cartilages of the knee are really the result of degeneration of the synovial fringes.

DR. OSCAR H. ALLIS called attention to the presence of synovitis in almost every one of the cases that Dr. Shaffer had cited, and the relief of that synovitis by means of a splint or the apparatus used. A synovitis of the joint is very apt to follow pinching or injury of these little movable cartilages. They are covered on two sides by synovial membrane, not attached to the tibia at any place except at their free ends, and could very easily be injured in such a way as, upon any slight occurrence, to give rise to a great deal of trouble. The splint Dr. Shaffer uses is as good as could be used. Some years ago he had occasion to use a similar splint, in which the knee-joint of the apparatus was checked at a given point, and it gave a great deal of satisfaction to the patient. Another point that he would call attention to in that splint was that the ankle-joint is about an inch lower than the ankle-joint of the patient. That is an exceedingly valuable point. It not only limits the motion of the limb, but yields a great deal more security, which, together with the restricted motion of the joint, is of the greatest value. Dr. Shaffer very properly limits the action of the joint; he prevents any rotation of lower portion of limb, and limits it, as he says, to a single motion,—namely, antero-posterior motion, so that the person cau-

tiously uses it, he is no longer instinctively afraid, and thus by degrees the joint becomes stronger and better, and returns to its original condition. He could not quite accept the idea that the elongation of the ligamentum patellæ is the predisposing cause of this disorder, since fracture of the patella—a very frequent injury and seldom cured without lengthening—is never followed by pinching of the cartilages.

DR. G. G. DAVIS said that the larger number of the cases which he had seen had followed injury, but he had often been unable to convince himself that there was any dislocation of the semilunar cartilage. There had been pain at the side of the joint, and that had been almost the only symptom. They had always seemed to resemble very much sprains of other joints of the body, and rupture and relaxation of ligaments would tend to account for many of the symptoms, but that relaxation of the ligamentum patellæ has any greater causation than relaxation of the lateral ligaments he could not say.

The fact of a skiagraph being produced he did not think settled the question. Skiagraphs are rather hard to interpret, and particularly so in these cases. He thought it would be more positive if the skiagraph had been taken of the opposite joint so as to compare it with the affected one. As Dr. Allis had pointed out, the increased length of the ligamentum patellæ in other cases does not produce these results. The explanation seems to him to be more simple, the joint being caught in some fixed position, and then the force continuing to exert itself had ruptured something; exactly what that something is cannot always be determined. Dr. Ashhurst has demonstrated that in some cases it is a semilunar cartilage, but, as a rule, he did not think one could demonstrate it.

When it comes to treatment, the first thing is simply to treat as an acute synovitis, with rest. Preferable to the plaster of Paris is a silicate of soda dressing; it is neater; can be made as firm as plaster of Paris, and, as the patient gets about, it can be slit down in front and removed at will. The apparatus of Mr. Marsh seemed to him to possess no power over the rotation of the leg. The object of treatment, to his mind, was prevention of rotation of the tibia upon the condyles. In the lighter cases, after using a silicate dressing, the next step would be to use a plain knee-cap, such as is made of rubber or part rubber and part leather.

This would limit rotation to some extent, though not to the extent of apparatus. A step further is an apparatus made of a leather band above and one below the knee-cap, joined by two side pieces of steel with a joint. The objection to this form of apparatus is its tendency to slide down upon the knee, and it has to be made of soft leather, and be particularly well laced and fitted, if this objection is not to be encountered. Perhaps because this objection has been found it is that Dr. Shaffer continued his apparatus to the foot. It would interest him to know why he continued it down the outer side. Personally, he would be inclined to continue it down the inner side and use it with a sole-plate inside of the shoe, which would obviate the necessity of using a joint which can be disconnected. The joints of apparatus wear out in a comparatively short space of time, and the use of such a joint shortens still more the period of its usefulness.

DR. RANDOLPH FARIES, with regard to a possible predisposing cause of the trouble, called attention to the fact that the condyles of the femur are not the same shape in every instance; nor are the cavities into which they fit the same, some are deep, while others are smooth. The synovial membrane is also thicker in some knee-joints than in others, and it is also true in regard to the ligaments in the knee-joint, both externally and internally. Under these conditions it seemed to him that sometimes one might ascribe the cause to the anatomy of the joint. If there is a smooth surface, the semilunar fibro-cartilages are easily dislocated. If, on the other hand, there is a semilunar fibro-cartilage with a deep cavity, the condyle fits more snugly, and dislocation is less apt to occur.

DR. SPELLISSY said that the habitual cause of this luxation is outward rotation of the tibia on the femur through forced eversion of the foot during flexion at the knee. Appliances designed to prevent such rotation have failed because they did not go far enough. Dr. Shaffer is the first, to his knowledge, who, in the treatment of this affection, had applied a brace reaching to the foot in the attempt to control its lateral motion. This thigh-leg-foot brace appears to absolutely eliminate rotation of the tibial head on the femoral condyles, and to limit eversion of the foot to that accomplished through outward rotation at the hip-joint. If desired, all rotation can be controlled by extending the brace to a band at the waist. Dr. Shaffer's appliance bids fair to

efficiently protect the knees to which it is adjusted. But these will be a very small percentage of the knees afflicted, because both patient and physician are apt to make the irreparable mistake of regarding the initial luxation as trivial. Then, when, through sad experience, the prospect of perpetual recurrence confronts them, it is usually too late to hope for cure. At this stage the joint has become chronically enlarged and loose and the patient habituated to its vagaries.

It is the *first* luxation that demands the most skilful handling and the efficient brace. With such treatment the primary luxation may hope for cure and ultimate emancipation from the brace. But later luxations must usually be content to choose between ever threatening and recurring luxation and the irksome and uninterrupted presence of a safe-guard. It is an extreme case that will resign itself to wear a brace throughout life merely for prevention.

These remarks were founded on the observation of three cases that had been under his care, and on the experience gained from some eleven luxations suffered by his own internal semilunar cartilage at the right knee, during the past four years.

The exciting cause of the primary luxation was an accident during the performance of a gymnastic feat. Repeated attempts to achieve the latter resulted in three consecutive luxations,—followed by as many reductions,—and all occurring within a few minutes. Treatment on this occasion was limited to a bandage.

Subsequent luxations followed trivial provocation. The first five were completely and promptly reduced, the cartilage being restored with a click, and full extension of the leg, impossible during luxation, was absolutely regained. But on the sixth occasion, attempted reduction by others having failed, Dr. T. S. K. Morton etherized him, and, although he much improved the condition by manipulation, the reduction was subjectively incomplete. The knee then had its second experience of plaster, and in time accustomed itself to its new position. But from that time hyperextension had been imperfect, and the affected knee was unable to go back like its fellow. The eighth and ninth experiences were repetitions of the seventh. The reduction of subsequent luxations he had accomplished unassisted and easily by a manœuvre that reverses the process of luxation. These latter restorations were accompanied by a click, but the position re-

gained was only that acquired after the sixth experience, and not the normal one.

The fifth luxation occurred while wearing an elastic knee-cap, and the ninth while in the clasp of a too loosely adjusted Marsh brace. This brace, worn over an elastic bandage, had been recommended to him by Dr. Morton. The combination is an excellent support and reminder, and, when in use, is invisible. It had saved him, he was sure, many recurrences, and he united with Dr. Young in its praise, but must add that it does not control external rotation of the tibia.

In his experience, this luxation is not apt to occur during most athletic exercises, even when no protection is worn, for at such times the muscles are particularly under mental control. But the moment of danger is when the mind is preoccupied or the individual is much fatigued, then, the muscles being relaxed, the joint is easily surprised into an awkward posture and the cartilage goes out. Of the eleven luxations in his own knee, but one was from hyperflexion alone, while ten were caused by forced eversion of the foot during flexion at the knee or *vice versa*, and of similar origin were the three cases he had attended in others.

DR. SHAFFER remarked that all are agreed that the semilunar cartilages are dislocated under various and varying circumstances. This dislocation rarely occurs in a perfectly normal joint. It had been his effort to throw some light upon the circumstances under which it was most likely to occur, and it seemed most likely that these circumstances involved some essential modification of the normal mechanism of the knee-joint.

His studies indicated that Dr. Sayre was wrong in stating that the cartilage becomes dislocated when the muscles are relaxed. It seems more likely that the strain comes upon the joint when it is unprepared, and that the sudden effort to brace the joint calls into play the sudden muscular effort which is the prime muscular factor in producing the dislocation. The patient would otherwise fall, and fall suddenly, as in floating cartilage, were it otherwise.

He was especially interested in Dr. Ashhurst's remarks on etiology. There is scarcely a week goes by without his seeing ligamentous relaxation in children, especially marked at the knee, when a condition of more or less spurious knock-knee exists. This is practically the condition found at the knee ligaments in

Hey's joint. These lax ligaments—mostly the crucial—will in many cases become shortened in childhood without any mechanical treatment, and this condition may be a predisposing factor of the lax joint which accompanies the semilunar cartilage subluxation. Any way, in all his cases of Hey's joint this ligamentous relaxation existed, and, while its etiology is obscure, it is not impossible an early condition of rachitis may be at the bottom of it all.

## REVIEWS OF BOOKS.

TRAUMATIC INJURIES OF THE BRAIN AND ITS MEMBRANES. By CHARLES PHELPS, M.D. New York: D. Appleton & Co., 1897.

This work is a systematic study of the injuries sustained by the brain and its coverings as the result of external traumatisms; and is based largely upon the author's observations of 500 recent cases. The book is divided into two parts. The first of these deals with the clinical aspect of brain injuries, general traumatic lesions, and a preliminary consideration of cranial fractures. The pathology, symptomatology, diagnosis, prognosis, and treatment are taken up in successive chapters and exhaustively discussed. The second section of the work is devoted to pistol-shot wounds of the head, discussed from the medico-legal and from the surgical stand-points. Finally, the work closes with the condensed histories of 300 cases of intracranial traumatism, 225 of which were verified by necropsy.

The studies of fracture of the base of the skull involve 286 cases, 110 of which recovered and 176 of which died. Autopsies were made upon 126 of these cases. It is of importance to note that the external signs of bloody oozing were present in sixty-seven of these cases, and that in sixty-one there was no bleeding from the ears, nose, or mouth, nor subconjunctival or subcutaneous ecchymosis. These observations corroborate the growing belief that bloody oozing is not present in the majority of cases of fracture of the base of the skull. The author's classified list of these cases, showing the location of fractures and the place of the external appearance of hæmorrhage, is of great scientific value. It demonstrates that too much diagnostic im-

portance has been attached to external bleeding in fractures of the base. In discussing the signs of this lesion, the author says, "There is still another and perhaps final direct symptom of basic fracture which may suggest its existence and location in the absence of more positive indications. It is an acute localized pain, different from the frontal, occipital, or diffused headache which is common in all forms of intracranial lesion. Its limitation and intensity serve to distinguish it from the pain of internal injuries, while it is disproportionate to the amount of superficial contusion. In fracture, limited to the posterior fossa, in which other direct symptoms are often wanting, it may afford the only ground for suspicion; and when it involves the mastoid process its import may be confirmed by the later appearance of subcutaneous hæmorrhage. It has been often noted in the cases appended, and its significance often established in subsequent post-mortem examinations. This symptom, which has been generally, if not entirely, overlooked, is sufficiently important to deserve attention." In this book, as in none other, is the question of fracture of the base, which for so long a time has been shrouded in mystery and regarded as a problem to be satisfactorily solved only by autopsic examination, removed from the domain of obscurity and conjecture.

The author urges the operative relief of all depressed fractures, whether brain symptoms be present or not. "The injunction to refrain from interfering with depressed fractures in the absence of complicating symptoms, however, is still widely upheld and respected in the profession, for no better apparent reason than the fact that many patients who are treated upon the expectant plan at least temporarily recover, notwithstanding the recognized dangers to which they are exposed. The influences of tradition and a failure to apprehend the changed conditions of modern surgery often content the general practitioner with the gambler's chance, and the patient takes all the risk." And, further, concerning the diagnosis he says, "The only rule that



can be formulated is that hesitation is always to be ended by sufficient exploration to resolve whatever doubt exists."

The discussion of intracranial hæmorrhage is particularly to be commended. The real causes of the symptoms arising from this accident are oriented upon physiological grounds. Thus the author shows that these peculiar symptoms are due to an anæmia of the brain caused by the intrusion into the already completely filled cerebral cavity of material which cannot be accommodated by the enlarging of the cavity, and therefore must cause a general compression of the collapsible vessels within the same. In this view it is shown that the general effect, aside from the purely localizing effects, of hæmorrhage, cerebral abscess, and compression of the skull is identical. For this reason the author objects to attempts at classifying these different pathological conditions, and prefers grouping the symptoms under their respective mechanical causes. For this reason, also, the distinction between compression and pressure is insisted upon. These should be regarded as mechanical agencies, and not as pathological conditions. Fracture or hæmorrhage may cause either pressure or compression, but the symptoms of the two pathic conditions are practically the same; those of the two mechanical conditions are different. Moreover, the author shows that the result of compression and of general brain contusion is the same. The frequent combination of these two conditions has led to confusion in the diagnosis.

Concerning structural changes in the brain, he says, "There is nothing in analogy to warrant at the present time the assumption that any fatal disorder terminates without involving structural change. It may properly be held, both from post-mortem observation and from analogy, that brain injury produces structural alteration with the same certainty that it occasions palpable symptoms."

In considering infective intracranial inflammations, the author has trenched largely upon Macewen's work. The pre-

sensation of the symptoms of brain injury is another of the commendable features of the work. The studies of changes in the pupils are particularly instructive. A lack of symmetry was observed in most cases of traumatic hæmorrhage. The pupils were observed to be normal in but five out of thirty-three cases. "In seven cases both pupils were dilated, the hæmorrhage in four being epidural, in two pio-arachnoid, and in one epidural and pio-arachnoid combined. In four cases both pupils were contracted, the hæmorrhage being in one epidural, in one pial, and in two both epidural and arachnoid. In six cases the pupil was dilated on the side of injury and contracted on the opposite side, while in two cases the pupil was contracted on the side of injury and dilated on the opposite side, the hæmorrhage in each being epidural, and derived from the middle meningeal artery. In three cases the pupil was dilated on the side of injury and normal on the opposite side. In three cases the pupil was normal on the side of injury and dilated on the opposite side." Thus the author observes that there seems to be no change in the pupil which can be regarded as characteristic; although in the majority of cases it is to be expected that dilatation of the pupil takes place on the side of pressure or compression.

The author's studies involve not only the superficial parts of the brain but also the more inaccessible regions, which are found not to be exempt from destructive alterations, though distinctive symptoms have not been separable from those of associated lesions. These observations involve seven cases of laceration and limited contusion of the corpora striata, and eleven cases of injury to the optic thalamus; and several cases of lacerations of the fornix, of the gyrus fornicatus, the pons, and basilar lobes.

The chapter on the diagnosis of brain injuries is of especial value, dealing, as it does, with the differential signs of opium-poisoning, uræmic coma, apoplexy, alcoholic coma, and other conditions, which may be confused with these. It is pointed out

how that dyspnoea and resulting cyanosis are not referable to compression of the medulla, but of the intracranial portion of the pneumogastric nerve. "The asymmetrical radial pulsations upon opposite sides of the body," the author observes, "which are so conclusive of the existence of some form of intracranial injury, afford no clue to the nature of the lesion." He holds that dilatation of the pupil upon the corresponding side of an epidural hæmorrhage is not due to injury of the brain, but to the direct compression upon the third cranial nerve. Fæcal and urinary incontinence in brain injury is shown to be an almost pathognomonic symptom of laceration, and is fairly constant when life is prolonged for any considerable time, and is of rare occurrence in simple hæmorrhage or contusion. It is shown to be unaffected by the region of the brain involved, and is independent of paralysis and loss of consciousness. "The retention of urine, which sometimes occurs in cases of hæmorrhage, on the contrary, is not indicative of the nature of the lesion, but is merely a result of the unconscious state, however produced."

The prognosis as exemplified by the 500 studied cases is reported as follows: Fractures involving the base of the cranium, 286; recovered, 110; died, 176; number of necropsies, 146. Fractures confined to the vertex of the cranium, 116; recovered, 75; died, 41; number of necropsies, 34. Encephalic injuries not accompanied by fracture of the cranium, 98; recovered, 41; died, 57; number of necropsies, 45. Summary: Total number of recoveries, 226; deaths, 274; necropsies, 225.

In the chapter on the principles of treatment, we take exception to the impression given by the author's statement that "the maintenance of aseptic conditions is not less an absolute necessity than in abdominal section," and hold that it is much more of a necessity. We also question the surgical wisdom of placing the reliance upon the probe as an instrument for determining the presence and location of bullets in the cranium, which the author advocates. Aside from this, the rules laid down for

the handling of gunshot wounds are based upon sound surgical principles. The studies of this class of wounds are particularly instructive, and teach the value of rational surgical interference and the dangers of pursuing the expectant plan of treatment. "There is probably no authenticated case of recent Anglo-American record in which a bullet left in the brain substance has failed to work mischief, nor has the evil been often long procrastinated."

The author is guilty of gross inconsistency and error in using the word "surgeon" in the following: "When the surgeon, disappointed and impatient at failure in his quest, thrusts the instrument into the brain recklessly and at random, or nervously again and again explores a channel which the first examination shows to lead to nothing tangible," etc. Surgeons do not deport themselves thus. Let the author substitute butcherous tyro or madman.

So much, then, for the critique of this most excellent work. It contains forty-nine illustrations; it is well written, edited, and printed; and is one of the most valuable contributions of our time to the literature of the surgery of the brain. It should be studied by every surgeon; and by the general practitioner, whose field of observation is limited, this work will be found of exceptional value.

JAMES P. WARBASSE.

MEDICAL AND SURGICAL REPORTS OF THE BOSTON CITY HOSPITAL. Ninth Series. Edited by CHARLES F. FOLSOM, M.D., W. T. COUNCILMAN, M.D., and HERBERT L. BURRELL, M.D. Illustrated. 8vo, pp. 276. Boston: Published by the Trustees, 1898.

MEDICAL AND SURGICAL REPORT OF THE PRESBYTERIAN HOSPITAL IN THE CITY OF NEW YORK. Volume III, January, 1898. Edited by ANDREW J. MCCOSH, M.D., and WALTER B. JAMES, M.D. Illustrated. 8vo, pp. 414. New York: Trow Directory Printing and Bookbinding Company, 1898.

THE METHODIST EPISCOPAL HOSPITAL REPORTS. Volume I, 1887-1897. Edited by LEWIS STEPHEN PILCHER, M.D., and GLENTWORTH REEVE BUTLER, M.D. Illustrated, colored plates. 8vo, pp. 563. New York: Published by the Hospital, 1898.

For years it has been the custom for many hospitals to issue annual reports, in which are set forth the many advantages of the institutions in question, the still larger number of adverse conditions with which they are obliged to contend, a list of the physicians in attendance, and a much longer list of the persons, with age, sex, and nationality appended, who have been admitted as patients during the current year, another list of the various diseases and operations in which the aforesaid doctors and patients have been implicated, a touching appeal for more money, and an equally touching statement of the individuals or societies who have given food, bed-spreads, or cash to help the institutions along on their beneficent career. Such reports are common, and, unless the name of the recipient appears somewhere in the pamphlets, they are usually consigned to the waste-basket.

A few institutions have issued reports which are something more than this mere collection of statistics. The uniformity of conditions, the permanent preservation of the clinical histories,

and of operation records, have been utilized, and the results of treatment of similar cases for a series of years are clearly shown. The lessons of hospital life thus cease to be of value to the favored few alone, and can be studied by the profession at large. Three reports of this latter class have recently been issued, and it is our purpose briefly to outline the scope of each.

In order of seniority the "Medical and Surgical Reports of the Boston City Hospital" is justly entitled to precedence, for this is the ninth series published. Like its predecessors, it contains much that is of interest and value.

From this report at least the inference may fairly be drawn that the medical service of the hospital is the pre-eminent one. The subject of diphtheria receives especial attention. "A Clinical Study of Eight Hundred Cases of Diphtheria," by John H. McCollom, M.D., "Heart Complications in Diphtheria," by Cleon Melville Hibbard, M.D., "Acute Degeneration of the Nervous System in Diphtheria," by John Jenks Thomas, M.D., and "The General Infections and Complications of Diphtheria and Scarlet Fever; a Bacteriological Study of 157 Cases," by Richard Mills Pearce, M.D., are the papers of this series. All of these articles are excellent, and indicate that the large number of cases have been utilized to the best advantage. Much stress is properly laid upon the pathology of this disease, so recently shorn of its chief terrors, and the painstaking investigations in this particular are to be commended.

There are a number of shorter medical articles of value. "Cerebro-Spinal Meningitis," "Endocarditis from Gonorrhoea," and "Amoebic Enteritis" are the most important topics treated.

In spite of the fact that 1646 operations were performed during the past year, the surgical service is but poorly represented in the report. A surgical abstract, by H. L. Burrell and John T. Bottomley, gives a brief report of a few abdominal cases of interest, and also the clinical history of three cases of actinomycosis and three of anthrax. This article is supplemented by

a tabular statement of the major amputations and their results. A more important article is by J. W. Courtney upon "The Clinical and Pathological Report of a Case of Fracture of the Spine in the Cervical Region, with some Statistics upon Fractures in this Region." The other surgical articles are of minor value.

Ophthalmology is well represented by an article upon "The Local Anæsthetics used in the Eye," by Walter B. Lancaster. John W. Farlow, a laryngologist, writes upon the "Treatment of Prolongation Forward of the Nasal Septum."

The practical questions so constantly arising in connection with hospital management are exemplified in two articles. The first gives a synopsis of the system of surgical services inaugurated in 1897; the second describes the routine work of the pathological laboratory of the institution. The necessity of accurate pathologic study and diagnosis is emphasized in many of the articles, and the system here outlined is productive of good results.

The Presbyterian Hospital of New York has just published for the third time a medical and surgical report, a well-edited and valuable volume of 414 pages. In this, as in the Boston report, the medical and surgical cases are mingled, no attempt being made to classify them by service. Here, too, the medical service greatly overbalances the surgical in the number and importance of the articles contributed.

So many of the medical articles are of value that it is difficult to assign especial importance to any particular one. A fitting companion to the classical monograph of Thayer is found in the article by Fred. P. Solley and Herbert S. Carter, entitled "The Malarial Fevers of New York." Although the work is not so exhaustive as that of their Baltimore colleague, it embodies the results of thorough and systematic research. The various types of fever are well exemplified by a number of temperature charts, and a plate illustrates the forms observed of the plasmodium itself.

"The Bacteriology of Blood in Disease," by Walter B. James and George A. Tuttle, adds materially to our knowledge in this domain, and the simplicity of the technique described has given such good results that other observers may now be induced to do similar work who have hitherto been deterred by the difficulties of method.

"Hydrochloric-Acid Determinations in Gastric Contents," by J. S. Thacher, and "Unusual Complications of Enteric Fever" are two other articles which are worthy of mention.

When the articles devoted to surgery are read, we must conclude that the members of the surgical staff have not done justice to the wealth of material at their disposal. The most important contribution is by Forbes Hawkes, "A Report of Forty-One Hysterectomies performed during a Period of Two Years in Dr. McCosh's Service." The operative technique employed, the after-treatment, and the results in this valuable series are well described.

Brain surgery receives two contributions: "A Report of Fifteen Cases of Abscess of the Brain," by E. S. Steese, also "The Surgical Treatment of Epilepsy, with a Report of Fourteen Cases," by Andrew J. McCosh. Both articles are excellent.

Charles K. Briddon writes upon the surgery of the kidney, the gall-bladder, the appendix, and the hip-joint. Each series of cases is short, but assist in establishing the best course of procedure in such cases.

"The Study of Twenty-Seven Cases of Pneumonia following the Inhalation of Ether and Chloroform," by E. C. Schultze, directs attention to the not infrequent occurrence of this complication as a result of anæsthesia, the importance of which is often underestimated in determining the relative mortality of the two inhalants.

The department of neurology is represented by a report of a case of multiple neuritis, with paralysis of the phrenic nerve as an important lesion. This is reported by N. Allen Starr, the con-



sulting neurologist; and George Thomas Jackson reports two dermatological cases complicating cardiac disease.

The reader cannot fail to be impressed by the high character of the work done in the department of pathology. The value of bacteriology is shown in the article upon the blood, already mentioned, and the hospital experience with the Widal test for typhoid fever, and with the tuberculin test for the presence of tuberculosis are both made the subject of articles. Microscopic pathology and histology is dwelt upon in a series of cases characterized by enlargement of the thyroid gland, and in another case where extreme leukæmic infiltration of the viscera existed; the illustrations in both of these articles are exceptionally good. Gross pathology is not neglected. Diphtheritic colitis of corrosive-sublimate poisoning, malignant endocarditis, and congenital tumor of the hard palate are all well illustrated.

These various cases, thus so carefully studied and presented to the profession, are concrete illustrations of some of the ideas advanced by William H. Draper, concerning "Some of the Collateral Functions of a Hospital." Post-graduate work of the highest grade, clinical instruction for both students and practitioners, and the general advancement of medical knowledge by means of bedside observation, operative procedures, and laboratory facilities are of as much and as material advantage to a community at large as is the cure of a certain number of patients.

The last of the group of reports to be considered is the one which has recently been published by the Methodist Episcopal Hospital of the city of Brooklyn. Ten years have elapsed since the Seney Hospital, as it is more frequently called, first opened its doors. It is therefore junior to most hospitals in the three cities.

"As this is the first publication of the kind emanating from this hospital, the medical and surgical essays are naturally preceded by an historical narrative, and a description of the buildings and of the administrative organization. These have been

furnished by the administrative officers of the hospital." In this introduction an account is given of the chain of events that culminated in the benefaction of Mr. Seney, and the ultimate establishment of the hospital. Had it not been for unexpected business reverses which prevented Mr. Seney from carrying out his original plan, no hospital in the country would have exceeded this in material equipment. As it is, the progress has been great, and excites our admiration for those who persevered and succeeded in the face of obstacles apparently insuperable.

The account given of each department and of the system of classification of patients and of services will be of value to those persons who are engaged in the practical administration of similar institutions.

Part II is devoted to surgical cases, for in this volume the surgical, medical, and pædiatric cases are arranged in three separate groups. No attempt has been made to include all the surgical cases, but rather to select certain subjects for study, and by systematic comparison of all the clinical histories bearing upon each subject make clear the advantages and disadvantages of each line of treatment pursued.

The first of the series is an article by Dr. Lewis Stephen Pilcher, entitled "Clinical Studies of the Surgical Diseases of the Female Generative Organs." "These diseases have not been set apart from other surgical affections as a distinct class to be placed in the charge of a surgeon who should limit himself to the care of this special group of affections, but have been cared for by the surgeons who have been intrusted with the general surgical work of the institution." Dr. Pilcher's service includes practically half of such cases that have been admitted. The classification adopted is by regions, vulva and perineum, vagina, uterus, Fallopian tubes, and ovaries and broad ligaments. In each group the number and kind of lesions treated are given, typical case histories are used to illustrate the class, photographs and a handsomely colored plate of pathologic finding, or of the

operative technique, are freely used to supplement the text. The article, in brief, illustrates the practical application of modern gynæcologic teachings.

Dr. George Ryerson Fowler is the author of the next report, devoted to the "Injuries of the Cranium and the Spine." Simple contusions and wounds of the scalp are first described, and then in order the more serious and extensive lesions of the skull and brain, with the frequent complications which develop after such injuries. The injuries of the spine are fewer in number, but are proportionally represented. In this article is included the pioneer case in which a bullet in the cranium was first located by means of the skiagraph, and then successfully removed by an operation. The use of the graduated pressure and telephone probe, which the author invented for use in this class of brain surgery, is described and illustrated.

No surgeon on either side of the Atlantic has contributed more to our knowledge of the diseases of the appendix than has Dr. Fowler, and most physicians will justly regard his second article upon "Appendicitis" as most valuable. It is an up-to-date supplement to the author's book upon the same subject. Seven full-page plates, painted from life by an artist, are reproduced in colors, and the clinical studies are concluded by a *résumé* of the symptoms and diagnosis of the disease, and a detailed description of the method of operation. Here, too, an artist has been employed, and each step of the operation, from the primary incision to the final closure of the wound, is graphically depicted. It is doubtless the best description of the operation that has as yet appeared.

Another article of great practical value is written by Dr. James P. Warbasse, "The Cases of Fracture of Bones," and based upon 980 cases that have been treated in the hospital. Each group of cases, according to the bone or bones involved, has been carefully studied; the results have been very satisfactory, and the methods by means of which the results were ob-

tained are clearly shown. In the application of ambulatory plaster splints and similar appliances Dr. Warbasse has done much original work, and the more important cases that can with advantage be treated in this way he has shown by means of photographs.

These are the major surgical articles, but the remaining ones, upon amputations, skin-grafting, tetanus, and anæsthetics, are all good and show painstaking research.

In this hospital surgery completely overshadows the medical and pædiatric services. The closing article, by Dr. Pilcher, upon "The Surgical Operating Arrangements and Methods," will be read with interest by those who keep abreast of the times in modern surgery.

Section III, medical reports, falls greatly below the high standard established in the previous section.

"The Cases of Acute (Non-Alcoholic) Poisoning," by Dr. R. W. Mead, will be regarded by most practitioners as the most important and practical in this part of the book. It gives detailed but well-condensed histories of the fifty cases that have been observed, and with each the treatment and result are noted. As this is a class of cases that is not dwelt upon at any length in most text-books of medicine, this series is of much importance.

"The Cases of Rheumatism," by Dr. Raymond Clark, are also well worked up, and while little is told that is new to the profession, the effects of systematic treatment under good conditions are interesting.

Dr. Glentworth R. Butler, in a short article, gives an excellent and convincing description of the mode of production and diagnostic meaning of the crepitant râle.

A case of Gilles de la Tourette's disease, another of actinomycosis of the lung, with recovery, and another of endothelioma of the pleura, are the chief cases of unusual interest that are reported.

The cases of typhoid fever, of thermic fever, of diseases of

the lungs, bronchi, and pleura, of the liver, of gastro-intestinal disease, and of nephritis are chiefly of value as showing the scope of the hospital work and the results of treatment.

The pædiatric service comprises Part IV. This service has been but recently established as a separate service; formerly children, though kept in a ward by themselves, were regularly admitted into the service of the attending physician or surgeon, as the case might be. The only series of cases here reported is by Dr. J. Bion Bogart, upon "Empyema of the Thorax in Children." Although short, it gives an excellent description of the disease, its diagnosis, and treatment. The conclusions reached are concisely stated, and arranged in a tabular form. They are progressive and worthy of adoption.

In the special departments, such as laryngology, ophthalmology, or neurology, there is no representative upon the attending staff; none of these departments, therefore, are represented in the report. There is, however, a moderate obstetric service, and a summary of such cases of pregnancy as have occurred is reported by Dr. Henry P. de Forest. This report gives some added statistics, especially in cases of albuminuria and ectopic gestation. A brief outline of the routine treatment of normal labor is also added.

In the department of pathology, Dr. W. N. Belcher contributes two reports, the one upon traumatic ruptures of the abdominal viscera, the other upon the cases of aneurism occurring in the medical service. Both are excellent, and represent a thorough study of the lesions involved.

When these three hospital reports are compared, it will appear that in the medical reports the Boston City and the Presbyterian divide the honors, with the importance of the contributed articles rather in favor of the latter institution. This is also true, in an even greater degree, with regard to the pathological work. When surgery is considered, the Methodist Episcopal Hospital Report is far superior to either of the others. In the special de-

partments there is but little difference, for the special reports in the Boston and the New York reports are counter-balanced by the obstetric and pædiatric sections of the Brooklyn institution. In the matter of beauty of illustration, quality of paper, and other factors of purely mechanical nature the Seney report is superior to that of the Presbyterian, and both are far better than the Boston City volume.

HENRY P. DE FOREST.

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ANNALS OF SURGERY,

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A. CLINICAL AND HISTOLOGICAL STUDY OF  
CERTAIN ADENOCARCINOMATA OF  
THE BREAST:

AND A BRIEF CONSIDERATION OF THE SUPRACLAVICULAR  
OPERATION AND OF THE RESULTS OF OPERATIONS  
FOR CANCER OF THE BREAST FROM 1889  
TO 1898 AT THE JOHNS HOPKINS  
HOSPITAL.<sup>1</sup>

By WILLIAM S. HALSTED, M.D.,

OF BALTIMORE,

PROFESSOR OF SURGERY IN THE JOHNS HOPKINS UNIVERSITY.

IN this communication I ask attention to the description of one or two quite rare but definite varieties of breast cancer, which we have encountered in the Johns Hopkins Hospital with sufficient frequency to enable us to recognize them clinically as well as histologically.

We have truly a cancer storehouse, for we save all of our malignant tumor material. In breast cases, the entire mass—fat, muscle, and all—is saved. Before it is severed from the body, in the course of the dissection, ligatures, black and white, are placed in it, here and there, as landmarks. When a flap of skin is to be dissected back its tip is left *in situ*, as a bearing point on the tissues to be removed. If by accident or design a scrap of tissue is dissected during the operation from the tumor mass it is at once labelled. When we are in doubt as to the cancerous involvement of the minute gland at the highest reachable point below the clavicle, it is sometimes dissociated by a special ligature. In making the inci-

<sup>1</sup> Read at the meeting of the American Surgical Association, April 21, 1898.

sions for the macroscopic examination of the tumor the best interests of the microscopic work are considered. We are, if possible, more fully convinced than ever of the value of painstaking scrutiny of the naked-eye appearances, and of detailed descriptions of all that can be seen on the freshly cut surfaces of the tumor and of the appearance and relation of the outlying parts. We have had occasion to regret the fact that the macroscopic findings have been insufficiently portrayed in some few of our earlier cases.

The block dissected from the neck, and eventually from the mediastinum, should be oriented, before hardening, as accurately as the main mass. The tissues should be hardened in Müller's or Zenker's fluid rather than in formalin or alcohol. If formalin should seem desirable in some special case, it might be used for three or four hours, after which Müller's fluid is to be substituted. Formalin interferes with the differentiation of elastic tissues by the orcein stain (E. Goldmann, *Beiträge zur klinische Chirurgie*, Band xviii, p. 595).

One person should be responsible for the preservation of the breast material from first to last. This was no light responsibility, even when the material was not nearly so abundant with us as it is at present.

Above all, the operator himself should study the material, in the operating room, immediately after the operation, and in the laboratory.

There is a gap between the surgeon and pathologist which can be filled only by the surgeon. The pathologist seldom has the opportunity to see diseased conditions as the surgeon sees them. A tumor on a plate and a tumor in the breast of a patient, how different! Its blood, its color, its form, its freshness, its consistency, are more or less lost when the tumor has been removed; the translucent zone of certain rapidly-growing cancers soon becomes opaque. Furthermore, the gross appearance of the new growth has for the surgeon a vital interest. He must decide at the operating table not only what is to be done at the moment, but he



should be able to give a more or less accurate prognosis. If there is a difference in the malignancy of malignant tumors, the operator, above all others, is the one to whom we should look for its interpretation. Not only are his opportunities greater than the pathologist's, but the incentive for the study of the fresh as well as of the hardened specimen is infinitely greater.

The patient's first impressions of the tumor, the presence or absence of pain at the beginning, the gradual increase of pain from almost imperceptible beginnings, the life of the new growth, the gradual disappearance of the fat between tumor and skin, the discoloration of the skin over the tumor or in its neighborhood, the local changes in the venous, arterial, capillary, and lymphatic circulations, the involvement of the skin and of the parts underlying the tumor, the shape and appearance of the tumor, the condition of the nipple as compared with its fellow, the gradual shifting of nipple (it may reach the axillary line), the comparison of the two breasts, of the axillæ, of the supraclavicular fossæ and of the groins, the circulation of the arm of the affected side, the involvement of the skin by metastases of the pleura, bones, and viscera, etc., these are some of the conditions which interest the operator more than the pathologist, and may assist him ultimately in connection with his study of the new growth itself to make some sort of a classification of breast cancers, and to determine their relative malignancy.

That breast cancers are not all alike every clinician knows; to some the patient succumbs in a year or less, others are borne for twenty years or more.

I know of no very successful attempt at classification of cancers of the breast with reference to their relative malignancy, and yet the importance of such a classification, if it were to any extent possible, is so evident that it is unnecessary to emphasize it. The histories alone of the operated as well as the unoperated cases give one a hint that there must be some basis for such a classification.

Many cancers of the breast contribute little if anything to the size of the organ, but some, certain adenocarcinomata and encephaloid cancers, for example, form tumors with considerable dimensions; the former may exhibit a slight tendency to pedunculation.

I find myself becoming inclined to welcome largeness, a suggestion of constriction at the base of cancers of the breast, and a tendency to break down as relatively favorable signs.

It would seem that we have been fortunate in meeting with a number of unusual adenocarcinomata, some of which have, perhaps, never been described; they may, however, have been seen and even described, but described beyond recognition. I have read long and careful descriptions of the minute appearances of tumors which might be interpreted to mean almost anything. If drawings were to be made by several individuals based on some of these descriptions, I doubt if any two of them would depict the same thing.

The particular adenocarcinomata which are so full of interest for us at this time, and to which I shall first call attention, I do not find described; and yet they are not so very uncommon. We have encountered five or six of them in less than 150 cases of breast cancer.

Permit me to proceed at once to a very brief consideration of these cases:

CASE I.—*Malignant Adenoma (Adenocarcinoma)*.—Surg. No. 6286; Path. Lab. No. 1705. Mrs. L. M., white, aged sixty-seven years, presented herself February 16, 1897, with a tumor growing in the site of a scar over the right breast. Two and one-half years before admission the patient struck her right breast in a fall; one month thereafter she noticed in this breast a little lump, the size of a pea, just under the skin. Within a year the tumor grew, painlessly, to be as large as a fist. Eight months before admission the tumor was removed by a local surgeon. At that time the skin over the tumor was bluish but not broken. Since the operation there has been a rapid recurrence of the tumor,



PLATE I.—Recurrent adenocarcinoma of the breast.



PLATE II.—(A) Adenocarcinoma of the breast.



PLATE II.—(*B*) Adenocarcinoma of the breast.

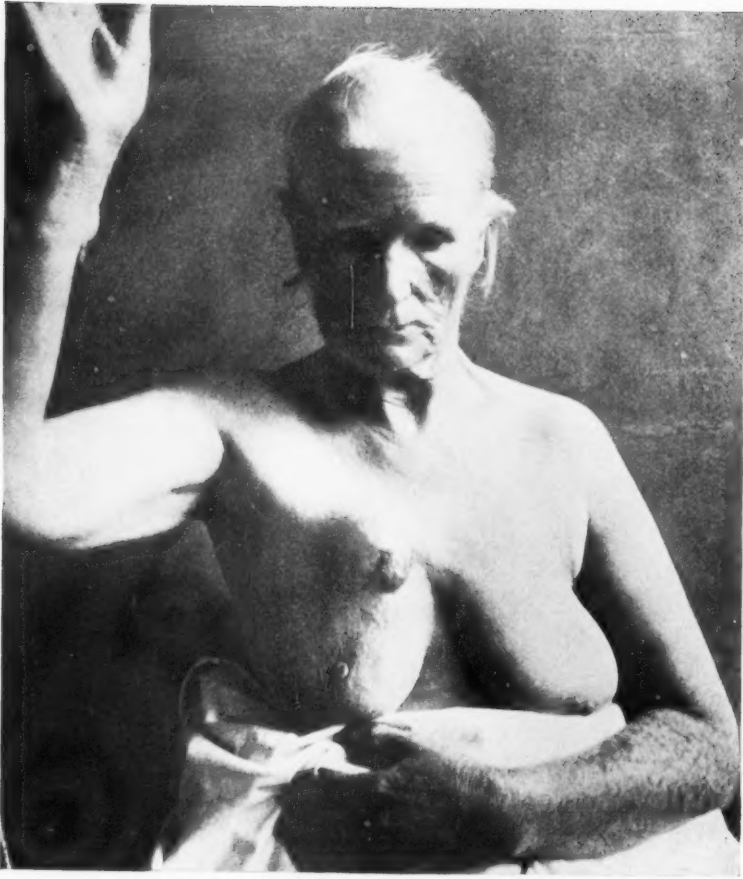


PLATE III.—Adenocarcinoma of the breast.

associated with occasional sharp-shooting pains. There has been no loss of weight or strength.

This patient was presented to me for the first time at my clinic, where I discussed the tumor, at length, before the class. It was a fungating tumor, pedunculated, and occupied the lower portion of the scar. There was also a small nodule in the upper end of the scar. (See Plate I.)

The entire convex surface of the tumor was ulcerated. One could squeeze a serum-like fluid from the tumor, the surface of which was covered by a necrotic film. I told the class that the tumor was certainly not an ordinary carcinoma, because of the considerable pedunculation, the peculiar serous fluid, the consistence of the tumor, etc. It was softer than the ordinary carcinoma of the breast, considerably softer everywhere except in one place, and this particular place, which was harder and could not macroscopically be distinguished from carcinoma, proved microscopically to be an adenocarcinoma in which the cells had already ceased to form any very definite combination figures. The tumor was removed at this same clinic by Dr. Finney, and the axilla was dissected out in the usual way. The glands in the axilla were enlarged, but careful microscopical examination of several of them has thus far failed to furnish evidence of carcinomatous involvement. The enlargement was due chiefly to endothelial proliferation.

That these glands were not carcinomatous, notwithstanding the fact that this was a recurrent tumor, would, in itself, have been very strong presumptive evidence that the tumor was not an ordinary carcinoma. Plate IV represents one microscopic field of this tumor. You will see at once how very different it is from any of the carcinomata of the breast which are described by the authors. Please observe that the tumor is made up chiefly of very large tubes which are lined with epithelium many cells deep.

In some of the tubes these epithelial cells might seem, at first sight, to be disposed without attempt at arrangement,

but a second glance discovers cell-combinations which have resulted in the formation of gland-like figures, circles, tubes, columns, and minute papillæ. The cells are often so snugly fitted together in these heavily lined tubes (or heavy tubes) as to conceal the original figures; but almost always, even when the tubes are completely filled with tightly packed cells, one can detect little circles of cells or little tubes which betray the tendency and the ability which the cells still have to form definite combinations. (See Plate IV.) Sometimes columns and circles anastomose in such a way as to form a mesh of more or less open net-work when there is room enough for such figures.

In certain parts this tumor has become pure carcinoma and has lost its adenomatous type; the epithelial cells, having lost their power to form combinations, lie irregularly and closely packed together in lymph-spaces.

Last September this patient wrote us that she was perfectly well, and that she was unable to detect any sign of a local recurrence of the tumor.

Sometimes the carcinoma and this peculiar adenoma, with its large, heavily lined tubes, seem to be growing side by side and independently, the carcinoma infiltrating the stroma, we might say, of the adenoma and suggesting, for the moment, a bitypic form of tumor. This bitypic form of growth characterized certain parts of the tumor in the following case:

CASE II.—*Malignant Adenoma (Adenocarcinoma)*.—Surg. No. 3175; Path. Lab. No. 511. Mrs. Mary P., colored, aged fifty years. Admitted June 14, 1894, with a large fungating mass measuring twelve centimetres by fourteen centimetres in the upper and outer quadrant of the left breast. (See Plate II, *A* and *B*.) Three years before admission patient first noticed a small nodule in this breast which has been growing steadily and painlessly ever since. For nearly two years the skin remained intact. Since September, 1893, nine months prior to admission, there have been frequent hæmorrhages from the surface of the



growth, caused, probably, by the sticking of the dressings. A thin, sanious, foul-smelling fluid constantly exudes from the surface of the mass. The edges of the tumor overhang the skin for about one to two centimetres on all sides. There was evidence of cancerous involvement of the neck of the uterus; nevertheless a complete breast operation was performed. The prognosis, so far as local recurrence was concerned, was unusually favorable; the axilla was not involved; the enlarged lymphatic glands showed endothelial hyperplasia.

When we state that an axilla is not involved, we mean that every gland and all of the fat having been exhaustively examined with the microscope, no evidence of cancer has been discovered.

The microscope, as I have said, revealed this association of the heavily lined, very large tubules in which the epithelial cells have preserved their ability to make more or less definite cell-combinations, and the small cancer alveoli occupying bitypically, as it were, the stroma of the adenoma. In other tumors and in other parts of this tumor one can see what would be called the transitions in all the desired forms, from the heavy tubes lined with cells in definite combinations to the finest lymph-spaces containing three or four epithelial cells without arrangement. We are often able to trace, even in the metastases of the purer carcinomata, indications of a tendency in the cancer cells to form combinations which recall the gland structure. This patient died of cancer of the uterus, two and one-half years after the breast operation. There was no recurrence of the breast tumor.

The following case does not strictly belong to this group. I introduce it because it presents in places a type of tumor which might, for the present, be regarded as transitional to the adenocarcinomata to which I have invited your attention.

CASE III.—*Scirrhus Carcinoma and Intracanalicular Papillary Adenocarcinoma* ("Duct Cancer").—Surg. No. 6059; Path.

Lab. No. 1611. Mrs. J. M. S., white, aged sixty-one years. Admitted November 30, 1896. Carcinoma of right breast, axilla, and supraclavicular glands. Metastasis in left femur, followed by fracture. Probable local recurrence near sternal edge of scar.

Patient did not suspect that she had a tumor until February, 1896. An increase in the size of the affected breast called her attention to it. She then examined it for the first time, and discovered a hard mass in the neighborhood of the nipple to which the skin was already adherent. She soon began to notice occasional stabbing pains, but otherwise experienced no discomfort from the new growth, which, instead of growing larger, steadily decreased in size from the time when she first discovered it until she came to the hospital. No fluid had ever escaped from the nipple.

On admission, the nipple was tilted upward; the eye detected no tumor in breast, axilla, or neck. The skin covering the breast was not ulcerated, but it was adherent to an underlying mass which could be felt surrounding the nipple. No fluid could be expressed from the nipple. Chart No. 1611 (not here reproduced), which Dr. Cushing kindly painted for me from the fresh specimen, shows the appearance of a section through the nipple and centre of the breast. A number of minute cysts were encountered in this section; two of them, larger than the others, are accurately represented in the colored chart. The largest of these two cysts measured one centimetre in diameter, and was almost filled by a little pedunculated ingrowth. The smaller cyst also contained a minute papilloma. Both of these larger cysts and some of the smaller ones scattered throughout the breast contained a dark and almost black fluid. Minute cysts in other parts of the gland were filled, some with a reddish-brown, some with amber-colored fluid, and some with contents resembling milk, or pus, or cheese. The smallest of these cysts formed hard, shot-like bodies in the breast, which can sometimes be diagnosed by palpation through the skin.

A diffuse scirrhus growth, about three centimetres by three centimetres, in which the larger and many small cysts were embedded, occupied about the centre of the breast and involved the overlying skin and the nipple. It was impos-



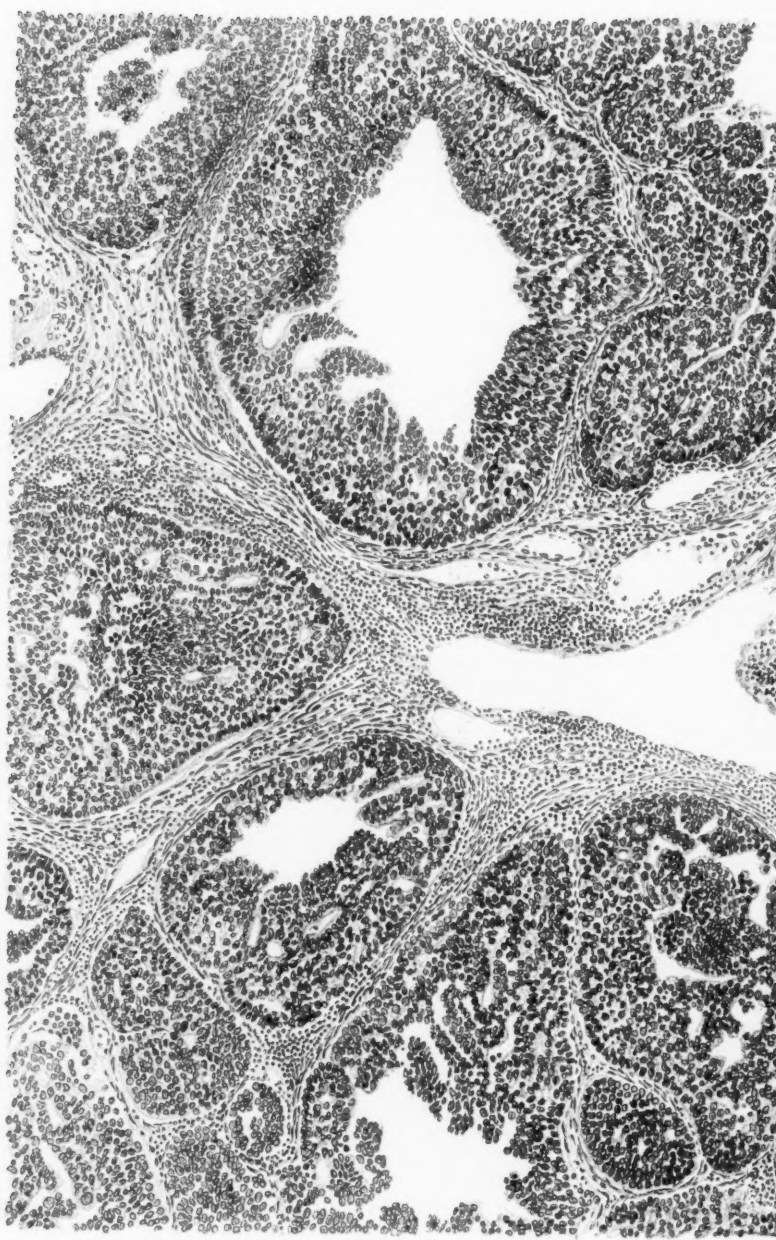
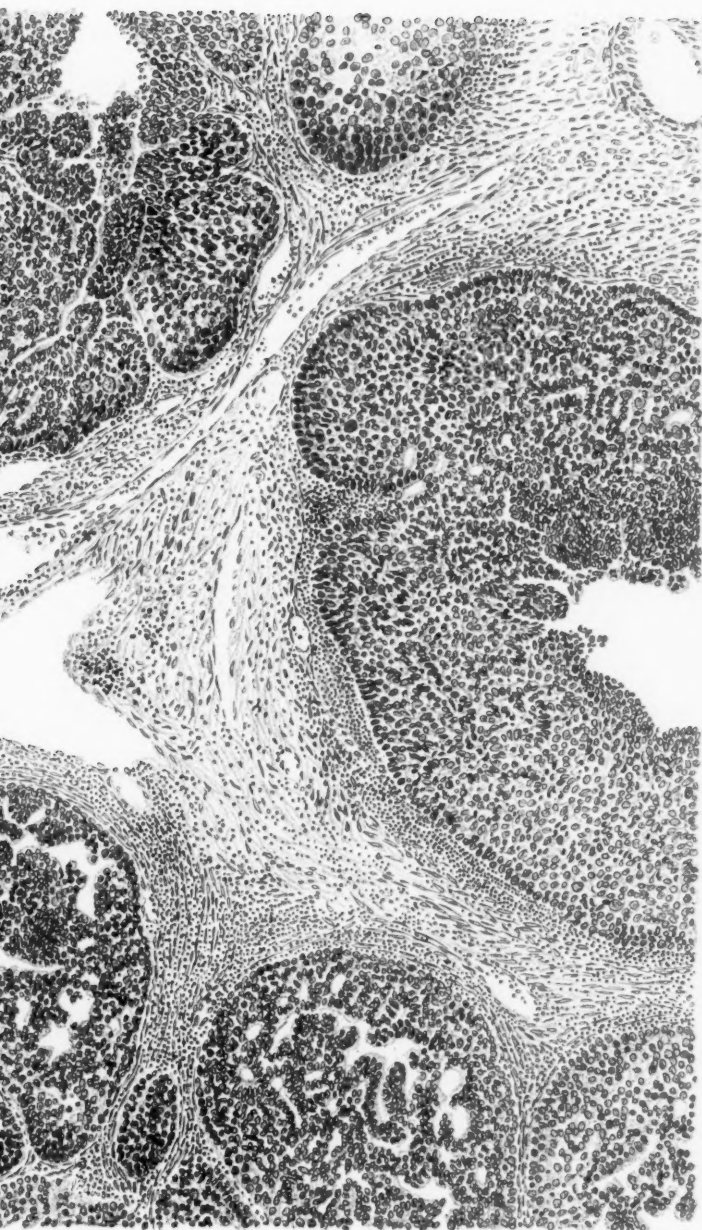


PLATE IV.—Adenocarcinoma of



*Max Brödel, fec.*

carcinoma of the breast.



C

PLATE V.— Carcinoma of the breast, *c*, *c*.



*H. Becker. fec.*

breast, c, c, c, and intracanalicular papillary adenocarcinoma.







sible with the naked eye to determine the limits of this cancer. Dr. Cushing succeeded in cutting and mounting a section of this tumor, which shows the tissues surrounding the cyst, the wall of the cyst, the pedunculated growth, and even the pedicle of the papilloma; and Dr. Hugh H. Young made for me the wall-chart, which represents so beautifully the microscopic appearances. Plate V, drawn by Becker, is a faithful interpretation of the same section. The pedunculated ingrowth is not one of the ordinary varieties of benign intracanalicular papilloma. It has very little stroma; just enough, perhaps, to support the parenchyma. It is chiefly parenchyma, and the epithelial cells form, apparently, combinations similar to those which we have described in the previous two cases,—combinations which result in the formation of the large heavily lined tubes. The pedicle is very delicate, transmitting a few vessels, but consisting chiefly of epithelium many rows deep on the surface, and exhibiting the tendency wherever feasible to form the heavy tubular combinations referred to. In the wall of the cyst, but one or two millimetres from its lining, we meet carcinoma, in which the cells have lost their power to form glandular combinations and appear as ordinary cancer cells incapable of further differentiation. In the glands of the axilla and in the neck were found metastases, most of them undifferentiated cancerous metastases, but some of them revealing the glandular type. This patient died one year after the operation with metastases.

The above case is a true scirrhus cancer, starting probably in the wall of a cyst, and should not be classed with the other five adenocarcinomata; but in Plate V you will observe that the cancer (*c. c. c.*) surrounds a little field of intracanalicular papillomatous adenocarcinoma (the villous carcinoma of Cornil and Ranvier, and the duct cancer of the English surgeons), which recalls in places certain pictures which are familiar ones in the other five adenocarcinomata. Large heavy tubes there are, two or three of them, which

resemble the heavy tubes of the other tumors, but are not precisely like them. There seems to be no tendency in the tubes of the duct cancer to form the rings and other cell-combinations which characterize the other five adenocarcinoma; and there is in this miniature duct cancer, as in all duct cancers, a very conspicuous tendency to produce intracystic villous growths. (See Plate V.)

CASE IV.—*Malignant Adenoma (Adenocarcinoma)*.—Path. Lab. No. 123; Surg. No. 2337. Mrs. M. P., white, aged sixty-five years. Admitted July 7, 1893. Eleven months before admission patient had noticed a tumor the size of a "walnut" in her left breast. On admission this tumor in the upper and outer quadrant measured  $4 \times 3 \times 3$  centimetres. It is not adherent to the skin or muscle, and the nipple is not in the least retracted. The complete operation below the clavicle was performed by Dr. Finney. In a note on the macroscopic appearance of a section through the middle of the tumor, Dr. Bloodgood emphasizes the fact that, on pressure of the tumor, a number of long, very fine, soft cylinders were extruded from the cut surface. These were, probably, the partially necrotic centres of the large tubes which I have described.

This was our first case of this variety of tumor. The axillary glands show endothelial hyperplasia, but no metastasis. The tumor was a malignant adenoma of precisely the same variety as those already described; but the type had remained pure, there being no areas of pure carcinoma and no transitional pictures. We had a letter from this patient a few days ago (April, 1898), stating that she was perfectly well, and that, so far as she knows, there is no evidence of local recurrence and none of metastasis.

CASE V.—*Malignant Adenoma (Adenocarcinoma)*.—Path. Lab. No. 204; Surg. No. 2565. Mrs. S. G., white, aged sixty years. Admitted October 18, 1893. Patient stated that five years before admission to the hospital she bruised the right breast badly; three months thereafter she noticed a small lump

in this breast which four years later became adherent to the skin. When operated upon the tumor measured  $4 \times 4 \times 3$  centimetres; it occupied the upper part of the upper and outer quadrant of the breast, over the sternal origin of the pectoralis major muscle. It was adherent to the discolored skin and apparently to the pectoral fascia. Plate III, although not a good one, shows at least that the growth was exuberant and would soon have become fungating. At the operation the prognosis was considered favorable, except for the fact that the muscle over the sternal ends of the second, third, and fourth ribs was infiltrated. It was, however, possible to give the local growth a fairly wide berth.

*Microscopic Examination.*—The tumor involved both skin and muscle, but there was no evidence of metastatic involvement of the muscle or other tissue. The axillary glands were enlarged (endothelial hyperplasia), but metastases have not been found in them.

April 1, 1898, four years and six months after the operation, this patient was examined by Dr. Bloodgood, who reported a perfect result; free use and no swelling of the arm, no sign of recurrence or metastasis, and excellent health of patient.

CASE VI.—*Malignant Adenoma (Adenocarcinoma).*—Path. Lab. No. 994; Surg. No. 4420. E. M., white, single, aged forty-two years. Admitted to the hospital July 15, 1895. One grandparent, one uncle, and one sister died of cancer; the sister with cancer of the breast. Scattered through the breasts are small, hard nodules, from three to five centimetres in diameter; in the left breast, the lower and inner quadrant, is a nodule which is harder and more tender than the rest, and which the patient has noticed for about three months only. This nodule measures about  $2 \times 3$  centimetres and is freely movable. The skin over the breasts is everywhere normal. The nipples are not retracted. The axillary and inguinal glands on both sides are sufficiently enlarged to be easily felt. July 17, 1895, the complete infra- and supraclavicular operations were performed by Dr. Bloodgood.

The suspected tumor occupied the sternal border of the

lower and inner quadrant of the breast; it was very hard and irregular in outline, not circumscribed, everywhere surrounded by breast tissue; on section it cupped, and from the cut surface, on which could be seen little yellow dots and lines, there could be expressed a soft, rather granular material. The breast tissue on the confines of the tumor differed in appearance from the rest of the gland, being pink in color instead of pearly-white, and studded with minute hæmorrhagic points. Between the nipple and this tumor is a second tumor resembling those found elsewhere in the same breast. On section this little tumor, one centimetre in diameter, instead of cupping, becomes elevated about two centimetres above the surrounding tissue; it is lobulated, and nothing can be expressed from its cut surface. Between this second tumor and the first there are smaller lobulated nodules resembling the main tumor in that a few minute areas of necrosis can be seen and partly expressed. Throughout the breast tissue, both outside of and within the nodules, are little cysts, which are brownish in color and contain a clear fluid.

*Microscopic Examination.*—The principal tumor is an adenocarcinoma of the large, heavy-walled cylinder type, which we are considering. The axillary glands, macroscopically large and soft and somewhat hæmorrhagic, contain no metastasis. This patient was heard from a few days ago (April, 1898). She reports herself perfectly well, with no sign of recurrence of the tumor, three years and nine months since the operation.

In each one of these five cases we have an adenocarcinoma of a type so distinct that we may advantageously consider them, for the present at least, as constituting a more or less specific class. In Cases IV (123), V (204), and VI (994) we have this adenoma pure throughout the neoplasm; Case VI was operated upon nearly three years ago; Cases IV and V nearly five years ago. Within the last three weeks they have all reported themselves as perfectly well and without a sign of return of the disease. In Case I (1705) the change from the adenocarcinoma to the purer carcinoma is apparently just beginning to take place in certain parts of the tumor, but the axillary glands, although much enlarged

from endothelial hyperplasia, show no involvement. This patient is also living without doubt; we heard from her last September in reply to our last letter.

In Case II (511) this same adenoma and the carcinoma were growing side by side in many parts in the bitypic manner already described, and still the axilla was not involved. This patient had a cancer of the uterus when we operated upon her breast. If the uterine tumor had been operable this patient might still be living.

The five cases of adenocarcinoma, which we have very briefly described, resemble in certain respects, and in other respects differ from, the so-called duct cancers. The duct cancers hitherto described have been small tumors, for the most part circumscribed, and resembled sarcomata; macroscopically as well as microscopically the villous nature of the tumor has always been conspicuous. That they bulge on section is frequently noted in the descriptions of these duct cancers; and by most they are said to be soft, very friable, and difficult to cut.

The adenocarcinomata which I have described resembled on section the carcinomata and not the sarcomata; a villous or papillomatous tendency was never apparent and not even suspected from the gross appearances of the freshly cut surfaces. Fine, worm-like cylinders of epithelium could be expressed from some of these tumors, but not from all. All of these new growths infiltrated the surrounding tissues just as carcinoma does. With the microscope the power of the epithelium to make ring-like combinations, as shown in the drawings, was very conspicuous, whereas the tendency to form villous growths was not so evident.

The histological details of these growths are reproduced with most gratifying truthfulness in the plates; and, when a sufficiently high power has been employed, each nucleus has been copied as faithfully as possible.

We have, I think, said enough about these adenocarcinomata to make it clear that they have striking clinical and

histological features in common; but we shall probably not succeed in drawing a very sharp line between this particular variety of adenocarcinoma and certain other adenocarcinomata in our collection. Some of the latter resemble the two cases described by Billroth as cystoadenomata; others, the thyroid gland. In one case the resemblance to the thyroid gland was remarkable.

It is quite likely that some of the little tumors which have been described as duct cancers are early stages of these adenocarcinomata.

We have several times met with just such cases as No. III,—a cyst or cysts with intracystic papillomata, and scirrhous cancer at the base of the villous growth.

*Operative Methods.*—Our present method of operating for the cure of breast cancer is even more radical than it was at the time of the writer's first publication on this subject. The supraclavicular region is almost invariably cleaned out. To do this we no longer divide the clavicle as we did five or six years ago; for simple division of the clavicle does not facilitate the dissection much, if any, and the removal of a piece of the collar-bone is a procedure which maims without sufficient compensation. If it were very desirable to remove the supraclavicular contents in one piece with the axillary contents and the breast, one might not hesitate to excise, if necessary, even the entire clavicle; but the removal of the supraclavicular fat and lymphatics is best done from within outward and from below upward, for in cleaning large veins like the subclavian and internal jugular the surgeon works to the best advantage if he starts at the vein and works away from it. The subclavian vein being the starting-point in the dissection of both the infra- and supraclavicular regions, it is unnecessary to remove the clavicle and useless to divide it. By elevating the shoulder the clavicle can be raised an inch or more away from the first rib when the operation is so far completed as to make this desirable. The web of fibrous tissue which binds the subclavian vein loosely to the clavicle

is thus spread out, and can be easily removed. The fingers can be passed from the supra- to the infraclavicular and to the subscapular regions under the clavicle, and any fat in the latter region, near the internal or the posterior border of the scapula between serratus magnus and subscapular muscles, which could not be reached well from the axilla can be drawn out through the neck. Dr. Bloodgood, my former house-surgeon, was, I believe, the first to demonstrate the advantages of completing the cleaning out of this postero-internal subscapular region by the supraclavicular route. To excise the supraclavicular tissues we use a vertical incision parallel with the sterno-cleido-mastoid muscle near its posterior border; a few of the posterior fibres of this muscle are divided and the junction of the internal jugular and sub-clavian veins exposed. At the angle of junction of these veins the dissection is begun. The omo-hyoid is divided at its tendinous part; the two bellies of this muscle being drawn out of the way and serving, in a measure, as retractors.

We have cleaned out the supraclavicular fossa in sixty-seven cases. Cancer was found in the tissues removed twenty-three times, or in 34 per cent. of these cases. In thirty cases there was no cancer, and in fourteen it is still uncertain whether the supraclavicular region was involved or not, because the tissues have not yet been exhaustively studied. Only those familiar with the work can understand the amount of labor implied in the statement that a given mass of the fat does not contain a cancer alveolus.

Not all of the sixty-seven operations above the clavicle were what we call primary; for fourteen of them were performed subsequent to the original operation and because supraclavicular glands could be palpated. Living and apparently free from metastasis three or more years after the primary operation are four cases whose necks were involved and cleaned out secondarily. Of these, two are living and well more than four years after the primary operation, and three and three and a half years respectively after the opera-



tion on the neck. In one of these latter cases I considered the prognosis desperately bad at both the infra- and supraclavicular operations. At the first operation the cancer had infiltrated the axillary fat diffusely, and could, with difficulty, be separated from the subclavian vein; at the second operation the same desperate state of affairs was encountered in the neck. A piece of the clavicle was exsected and a very thorough operation performed. We were pleased to find at the second operation that there was no evidence of recurrence in the axilla. It is now more than three years since the neck operation was done, and the patient, whom I saw a few days ago, feels perfectly well, and has no signs of recurrence or metastasis.

When these statistics were prepared, the neck operation, as we call it, had been performed primarily fifty-three times; in twelve of these cases, about 23 per cent., the supraclavicular tissues were involved.

It is to be hoped that others have reached the conclusion that we should not abandon as hopeless all cases of breast cancer in which there is supraclavicular involvement. Indeed, I fail to see why the neck involvement in itself is more serious than the axillary. The neck can be cleaned out just as thoroughly as the axilla. Dr. Bloodgood, instructor in Surgery, has, on the necks of two patients, done as many as three operations each for glandular involvement, and apparently saved his patients. The additional operations were for glands above and below the region of the neck first attacked. In one of these cases he entered the mediastinum from above to remove a cancerous gland, and had to excise a piece of the innominate vein. Dr. H. W. Cushing, my house-surgeon, has in three instances cleaned out the anterior mediastinum on one side for recurrent cancer. It is likely, I think, that we shall, in the near future, remove the mediastinal contents at some of our primary operations.

As I have said, we clean out or strip the supraclavicular fossa with very few exceptions at the primary operation. It



would be unwise, I think, to postpone this operation until enlarged glands can be palpated above the clavicle, for we not infrequently find in the tissues removed cancerous glands too small or too deeply embedded in fat to have been felt through the skin, and often a large gland or several glands at the junction of the subclavian and internal jugular veins which were too deeply buried behind the clavicle to have been detected before the operation. The axilla offers no criterion from which we might draw inferences as to the condition of the supraclavicular fossa. Sometimes, with an axilla which is involved chiefly in the lower or arm part, and apparently not at all in the upper or subclavian part, we have a neck involved solely at the junction of the internal jugular and subclavian veins. This state of things was present in a recent case in which I had a considerable personal interest. The patient was a young lady whom I was very loath to disfigure, and as the higher or subclavian part of the axilla seemed free from cancer, and nothing suggestive of cancer could be detected in the neck, I said to my assistants that I would not touch the neck. But upon examining the breast and axillary contents removed, I was so much impressed with the unusual malignancy of the little cancer that I returned to the table and stripped the supraclavicular fossa. Several cancerous glands were found at the junction of the great veins and internal to the inferior thyroid artery.

It sometimes happens, on the other hand, that the neck is not involved, although the axilla is a solid mass of cancer. Hence, it would appear that for the present our rule should be, *operate on the neck in every case*. The neck operation should not be postponed for a second act. It can never again be done so well as at the first operation, when the axilla is open, the subclavian vein fully exposed, and the clavicle free. In the main operation we have made some changes. We remove the minor as well as the major pectoral muscle, dividing the insertion of the major and then its origin and the origin of the minor, before we expose the subclavian vein. This vein is first exposed at its inner part, and the axilla

stripped of its contents, and its anterior wall at one time from within outward and from above downward, as heretofore. We have made no change in the skin incision; indeed, I should hardly know how to do so; one must always circumscribe the mass to be excised with a circular or an oval incision, and must make additional cuts to expose axillary and jugular veins. Tumors should never be harpooned, nor should pieces ever be excised from malignant tumors for diagnostic purposes. Think of the danger of rapid dissemination of the growth from injecting cancer of the tongue with cocaine and then snipping off a piece of the tumor with a scissors.

In studying the published histories of cases of malignant tumors, particularly sarcoma, I have been impressed with the great number of cases in which general dissemination of the neoplasm has seemed to follow swiftly upon exploratory incisions.

Breast tumors should not be incised on the operating table prior to their removal. The surgeon must learn to recognize malignant tumors not only with the microscope, but also with his naked eye and fingers.

There are, of course, tumors which cannot be diagnosed until an incision has been made into them or into the axilla. For example, a large benign cyst may have a tiny cancerous spot in its wall, or a very slowly growing carcinoma may be sharply defined or even encapsulated and resemble on palpation a benign tumor. If the surgeon cannot, in a given case, make a diagnosis prior to operation, an exploration of the axilla might help him; if still in doubt, he should excise the breast or, at least, give the tumor a wide berth. If then, on incision, the tumor proved to be malignant, the complete operation should be performed immediately.

Operating for the cure of cancer is a very great labor. We never attempt more breast cancers than one in a day. The operation, including the toilet of the wound and the grafting, requires from two to four hours with highly trained and skilful assistants; it is performed in an absolutely blood-

less manner, and the patient, in consequence, suffers not at all from shock. Three days ago, for example, in a three-hour operation, the patient's pulse ranged from 66 to 70 throughout the entire operation. At all operations a record of the pulse is kept on what we call the *ether chart*, introduced by my house-surgeon, Dr. Cushing. We remove rather more skin than we did originally, and in all cases we graft the wound immediately. Grafts are cut from the patient's thigh as large as or larger than one's hand. A single one of these large grafts may be enough to cover the raw surface. In cutting a graft of this kind the skin is made tense by a board which the operator slides along the thigh just in front of a large amputating knife or catlin. The graft is spread, raw side up, on a piece of rubber tissue, and from the latter is readily transferred to the breast wound. It is finally covered with silver foil and tissue paper, and need not be looked at again for two or more weeks. The silver foil makes an ideal dressing for grafts, very much better than anything else we know of. For several years we hesitated to graft these cases at once, fearing to prolong the operation another half-hour; but now we have become accustomed to these very long operations, and have learned that they may safely be continued almost indefinitely if they are bloodless and if the anæsthetic is properly given.

*Results of Operations for Breast Cancer at the Johns Hopkins Hospital from June, 1889, to April, 1898.*—During the past two years my assistants, Drs. Finney, Bloodgood, and Cushing, have probably performed the majority of the breast operations; prior to this, almost all of the breast cancers were operated upon by the writer. One hundred and thirty-three cases have been operated upon; seventy-six of these more than three years ago. There have been thirteen (9 per cent.) local and twenty-two (16 per cent.) regionary recurrences. Of the seventy-six cases operated upon three or more years ago, thirty-one (41 per cent.) are living without local recurrence or signs of metastasis; ten died more than three years after the operation, and one as late as five and a half years

thereafter; of these ten, one had a local recurrence. Forty cases, therefore (52 per cent.), lived more than three years without signs of local or regionary recurrence. Some of the ten cases which died may have had at three years signs of metastasis; I cannot make a positive statement as to this point. Thirty-five cases (46 per cent.) died within three years of the operation, and seven of these with local recurrence.

OBSERVATIONS UPON THE OPERATIVE TREAT-  
MENT OF HERNIA AT THE HOSPITAL  
FOR RUPTURED AND CRIPPLED.

By WILLIAM T. BULL, M.D.,

OF NEW YORK,

ATTENDING SURGEON TO THE NEW YORK HOSPITAL; ATTENDING SURGEON TO  
THE HOSPITAL FOR RUPTURED AND CRIPPLED, AND CONSULTING  
SURGEON TO THE NEW YORK CANCER HOSPITAL,

AND

WILLIAM B. COLEY, M.D.,

OF NEW YORK,

ATTENDING SURGEON TO THE NEW YORK CANCER HOSPITAL; ASSISTANT SURGEON  
TO THE HOSPITAL FOR RUPTURED AND CRIPPLED.

DURING the years September, 1890, to September, 1897, inclusive, there were treated at the Hospital for Ruptured and Crippled 34,271 cases of hernia. Of these 28,892 (male, 24,810; female, 4082) were inguinal; 1927 (male, 558; female, 1369) were femoral; 2795 (male, 1078; female, 1717) were umbilical; 658 (male, 229; female, 429) were ventral.

In our previous report, published in the ANNALS OF SURGERY in 1894, we described at some length the details of the methods of mechanical treatment employed at this institution. Since these methods have not been modified to any important extent, we shall, in the present report, confine our observations to operative treatment and its results.

Prior to September, 1890, or during the years 1889 and 1890, nineteen cases of hernia in children were operated upon at the hospital for radical cure by the older methods of Socin, Czerny, and Risel, with the result that 50 per cent. relapsed during the first year. So discouraging were the results that Dr. Bull, in his paper read before the American Surgical As-

sociation, on May 14, 1890 (*Medical News*, July 5, 1890), stated: "Of the cases in children, it may be said that they prove or disprove nothing; prompt recurrence in cases where the sac was not found, shows the importance of obliterating it by any method of cure as well as the uncertainty of simple closure of the pillars of the external ring with sutures."

In the fall of 1891 it was decided to make another trial of operation in children, with a view of being better able, from a more extended experience, to determine its real value. The first operation in the new series, a right inguinal hernia, in a boy aged eight years, was performed by Dr. Coley December 12, 1891, by the Czerny method, using non-chromicized catgut. The wound healed by primary union, but two months later there was a slight relapse. A truss was applied, and four years later there was only a slight impulse on coughing. The second case, a boy fifteen years of age, was the first case operated upon by Bassini's method. The hernia was very large. Owing to lack of familiarity with the method, the operation was prolonged. Silk was used for the buried sutures. The wound suppurated badly; nearly all of the sutures were extruded, and a relapse promptly followed.

This was certainly not a very favorable beginning. Kangaroo tendon was soon substituted for silk, and Bassini's method almost uniformly adopted with extremely satisfactory results. From December 12, 1895, to September 20, 1898, 400 operations were performed at the hospital for the radical cure of inguinal and femoral hernia. Of this number forty-three were operated upon by Dr. John B. Walker, assistant surgeon to the hospital, and the remainder by the writers. Of this number 352 were males, 48 females. Inguinal, right, 199; left, 99; double, 42. Femoral (females, 9; males, 5), 14; ventral, 3; lumbar, 1.

*Methods and Results of Operation.*—Bassini's method, with kangaroo tendon, 342 cases; Bassini's method, with silk sutures, 1 case; slitting up aponeurosis of external oblique with high ligature of sac and closure of canal in three layers

with kangaroo tendon without transplanting cord, 34 cases. Socin's and Czerny's, 5 cases; femoral hernia, 14 cases. Wound healing: primary union, 373 cases; slight suppuration, 15 cases; much suppuration, 9 cases; died, 3 cases; relapsed (Bassini's), 3 cases; suture of canal, 3 cases.

*Duration of Cure or Period of Observation.*—Much time and effort have been spent in tracing these cases to final results. Most of the cases have been kept under continued observation, and all but 23 have been traced, with the following results: Of the 400 cases, 142 were well over two years; 94 well from one to two years. Cases well over five years, 12; from four to five years, 25; from three to four years, 28; from two to three years, 80; from one to two years, 94; making 236 well beyond one year, and 142 beyond two years. Of the cases in which the cord was transplanted, 10 were well over two years; 19 from one to five years. Of the femoral herniæ, 4 were well over two years. All but 23 cases were traced; of these 13 were Bassini's, 2 umbilical, 3 femoral, and 5 cases of inguinal hernia in which the cord was not transplanted.

In two cases followed by relapse a Czerny operation had been performed for recurrent hernia, and under conditions not favorable for radical cure. In two cases Bassini's operation was performed for a speedy relapse following Czerny's method. Both cases are now well upward of five years after operation, no truss having been worn. These cases prove the value of Bassini's method as a secondary operation in cases of failure following other methods.

*Mortality.*—The total mortality in the series of 400 cases is 3,—less than 1 per cent. The cause of death in these cases was as follows: (1) Double pneumonia (caused by ether), death occurred on sixth day. Autopsy confirmed diagnosis, and showed no abdominal or wound complications. (2) Acute peritonitis from wound infection. (3) Pericarditis, with pneumonia complicated with wound infection in a very weakly child with spinal disease.

*Dangers and Complications associated with Operation.*—

The chief dangers to be guarded against are pneumonia and wound infection, and the former we believe to be the more dangerous. During the past year we have had the services of a skilled anæsthetist (Dr. Thomas L. Bennett). Nitrous oxide gas is employed for a few moments, then followed by ether. This method makes it possible to fully anæsthetize the child in from two to three minutes; does away with struggling, and materially lessens the quantity of ether inhaled.

*Precautions against Infection.*—The methods employed in cleansing the skin of the patient and hands have been those usually adopted. Until the past year the hands were cleansed by green soap, hot water, alcohol, and perchloride of mercury,—1 : 1000; during the past year the chloride of lime method has been largely used. The results have not been materially better under the latter method, as they were nearly perfect before. Ninety-five per cent of primary union in hernia operations is very high, and has never, we believe, been equalled. The skin of the patient is prepared on the preceding day by means of a full bath, thorough local scrubbing with tincture of green soap, and a green soap poultice for from four to five hours. This is taken off, and a moist bichloride dressing (1 : 3000) is applied, and allowed to remain until the patient is etherized; a final scrubbing is then given with tincture of green soap and alcohol and ether. During the past six months a careful series of bacteriological tests have been made at all operations by Dr. B. H. Buxton, the hospital pathologist.

*Bacteriological Experiments.*—The skin from operation field was examined in 38 patients: sterile in 33 cases; culture growth in 5 cases.

*Scrapings from Nails of Operator.*—(A) Prepared by (1) tincture of green soap; (2) alcohol, 95 per cent.; (3) bichloride of mercury: sterile, 10 cases; culture growth, 13 cases.

(B) Prepared by (1) tincture of green soap; (2) chloride of lime; (3) washing soda; (4) alcohol, 95 per cent: sterile, 6 cases; culture growth, 7 cases.



*From Nails of Assistants.*—(A) Prepared by (1) tincture of green soap; (2) alcohol, 95 per cent.; (3) bichloride of mercury: sterile, 50 cases; culture growth, 2 cases.

(B) Prepared by (1) tincture of green soap; (2) chloride of lime; (3) washing soda; (4) alcohol, 95 per cent: sterile, 10 cases.<sup>1</sup>

*Healing of Wounds* (in which above bacteriological tests were made).—Primary union, 39 times; prolonged suppuration, once; superficial suppuration, once. With three or four exceptions the culture growths were the skin coccus, though in one case streptococci and in one staphylococci were found. It is a remarkable fact that of sixty tests of the nails of the assisting house-staff, cultures were found in but 2; this is a most creditable showing as compared with the recently published experiments of Mikulicz (*Archiv für klinische Chirurgie*, Band lvii, Heft 2, S. 243), who found the skin infected in 47 per cent. of cases prepared by the "alcohol-sublimate" method; and the hands infected in 66 $\frac{2}{3}$  per cent. in 72 experiments in 1896-97. Mikulicz's investigations bring out a very important fact, and one too little recognized by the majority of surgeons,—viz., the importance of rapidity in operating, if primary wound healing is to be attained. His experiments showed that, though the hands of the surgeon and assistants might be sterile at the beginning of an operation, they never remained so at the end of a prolonged operation, and he concludes that "the danger of infecting the wound increases with the length of the operation." Infection in our own cases strongly supports this conclusion.

*Suture Material.*—Silk was used in two cases, with the result of bad suppuration in one case with the extrusion of the sutures; in the other, the wound apparently healed by primary union; but later a small sinus developed and the sutures came out. Relapse followed in both cases within four months. In four cases chromicized catgut was used, and in

<sup>1</sup> We are indebted to Drs. A. H. Cilley and W. T. Mercereau for a careful record of these bacteriological tests.

one simple catgut. In the remainder, 394 cases, chromicized kangaroo tendon was employed.

In former papers we have strongly expressed our preference for absorbable sutures sufficiently durable to permit of tendinous union. While we still employ kangaroo tendon, and on account of its strength and pliability regard it as superior to chromicized catgut, its expense and the difficulty of getting it in proper size and of even calibre are disadvantages.

Our objections to non-absorbable buried sutures, including silk, silkworm gut, and silver wire, were based upon observations of sixteen cases, in which the use of such sutures was followed by the subsequent formation of sinuses and the extrusion of the sutures. These objections were very serious, inasmuch as the healing of the sinuses often required many months, and the prolonged suppuration so weakened the canal that, in most cases, relapse followed. Our opinion has been further confirmed by more recent observations as well as by the published results of other surgeons. The following table gives in brief the histories of twenty-seven personal observations:

TABLE SHOWING CASES IN WHICH SINUSES DEVELOPED AFTER OPERATIONS IN WHICH NON-ABSORBABLE SUTURES WERE EMPLOYED.

CASE I.—Age and sex, male, sixty years. Variety of hernia, right inguinal; size of cocoanut. Date of operation, December, 1894. Method of operation, Phelps's. Suture material, silver wire. Wound healing, three months in hospital; suppuration. Final results, November 26, 1895, sinus three inches deep; never treated since operation; five to six inches of silver wire extracted by Dr. Weir, New York Hospital; no relapse.

CASE II.—Age and sex, male, twenty-four years. Variety of hernia, left inguinal; twelve days; duration small. Date of operation, August 12, 1895. Method of operation, Bassini's. Suture material, silk. Wound healing, thirty-four days; suppuration. Final results, December 27, 1895, four and one-half months; sinus large; purulent discharge; silk suture extruded.

CASE III.—Age and sex, male, twenty-seven years. Variety of hernia, right inguinal; seven years. Date of operation, September 3, 1895. Suture material, silkworm gut. Wound healing, twenty days; primary. Final results, February 17, 1896, five and a half months; per-

sistent sinus; first appeared six weeks ago; February 20, 1896, silkworm-gut suture extracted by Dr. Bull; no relapse; March 24, 1896, relapse; size of an egg.

CASE IV.—Age and sex, male, twenty-three years. Variety of hernia, right inguinal; small. Date of operation, May, 1890. Suture material, silkworm gut. Wound healing, six weeks. Final results, two months after leaving hospital small abscess developed, and sinus discharged six months, when silkworm-gut suture was extracted; relapse seven months after operation.

CASE V.—Age and sex, male, twenty-eight years. Variety of hernia, right inguinal; size of an egg. Date of operation, September 3, 1895. Suture material, silkworm gut. Wound healing, twenty-one days; primary. Final results, three months later sinus developed; hernia relapsed six months after operation.

CASES VI and VII.—Age and sex, female, thirty-three years. Variety of hernia, left inguinal; Alexander's operation on right side. Date of operation, November 25, 1893. Method of operation, double. Suture material, silver wire on one side, silkworm gut (?) on the other. Wound healing, primary, four and a half weeks. Final results, soon after leaving hospital the discharge appeared in both sides; sinus continued six months, then healed; six to seven months later reappeared on both sides, and remained when last observed; May 25, 1896, two and a half years, relapse on left side.

CASE VIII.—Age and sex, male, twenty-eight years. Variety of hernia, left inguinal. Date of operation, May 15, 1896. Method of operation, Bassini's. Suture material, silkworm gut. Wound healing, seven weeks in bed; suppuration. Final results, persistent sinus followed operation; five months later wound cut down upon, and four sutures removed.

CASE IX.—Age and sex, male, sixty-four years. Variety of hernia, left inguinal; size of an egg. Date of operation, December 14, 1896. Suture material, silk. Wound healing, primary. Final results, ten weeks later sinus developed, discharging when last seen, three and a half months later; some sutures extruded; no relapse.

CASE X.—Age and sex, male, fifty years. Variety of hernia, right inguinal. Date of operation, December 20, 1893. Suture material, silk. Final results, March, 1894, unhealed sinus; three to four silk sutures extruded; relapse four months after operation.

CASE XI.—Age and sex, male, thirty-nine years. Variety of hernia, right inguinal. Date of operation, May 18, 1891. Suture material, silkworm gut. Final results, sinus developed; two months in healing, after several sutures have been cast off; relapse in few months.

CASE XII.—Age and sex, male, twenty-seven years. Variety of hernia, inguinal. Date of operation, 1888. Method of operation, Macewen's. Suture material, silver wire. Wound healing, suppuration; seven weeks in hospital. Final results, four months after operation; sinus unhealed, and relapse shortly after.

CASE XIII.—Age and sex, male, forty-four years. Variety of hernia,

inguinal. Date of operation, April, 1888. Suture material, silk. Final results, discharging sinus, October, 1888, seven months later; relapse shortly after.

CASE XIV.—Age and sex, male, thirty-four years. Variety of hernia, inguinal. Date of operation, June, 1894; September and December, 1894. Suture material, silk. Final results, sinus unhealed, February 19, 1895, two and a half months later.

CASE XV.—Age and sex, male, forty-six years. Variety of hernia, left inguinal. Date of operation, October, 1894. Suture material, silver wire. Wound healing, in bed seven weeks. Final results, May 7, 1895, seven months later, discharging sinus; hernia relapsed.

CASES XVI and XVII.—Age and sex, male, fifty-six years. Variety of hernia, double inguinal. Date of operation, December 8, 1894. Wound healing, three months in hospital. Final results, May 17, 1895, sinus on both sides, and bad relapse on right.

CASE XVIII.—Age and sex, male, forty years. Variety of hernia, double inguinal. Date of operation, May 17, 1895. Method of operation, Bassini's; double. Suture material, silk. Wound healing, seven weeks in bed. Final results, persistent sinus on both sides; relapse on both sides two months later.

CASE XIX.—Age and sex, male, forty-five years. Variety of hernia, right inguinal. Date of operation, January 26, 1895. Method of operation, Bassini's. Suture material, silkworm gut. Wound healing, primary. Final results, shortly after leaving hospital small sinus developed, remained eight months, when incision and removal of ligatures caused it to heal; October 3, 1895, marked relapse.

CASE XX.—Age and sex, male, fifty-two years. Variety of hernia, right inguinal. Date of operation, April 6, 1888. Suture material, silkworm gut. Wound healing, primary. Final results, sinus developed May 27, and kept patient from work till October 24, 1888; hernia relapsed.

CASE XXI.—Age and sex, male, fifty-two years. Variety of hernia, right inguinal. Date of operation, second operation, February 9, 1892. Method of operation, Bassini's. Suture material, silkworm gut. Wound healing, primary. Final results, four months later sinus, and removal of suture; two and a half years after operation, sinus and suture removed, under ether; three years and eight months after operation, a third sinus and suture removed; healed.

CASE XXII.—Age and sex, female, fifty-eight years. Variety of hernia, right inguinal. Date of operation, April 4, 1897. Suture material, silk (?) Wound healing, five weeks. Final results, sinus two and a half months after operation.

CASE XXIII.—Age and sex, female, sixty years. Variety of hernia, right inguinal. Date of operation, March, 1897. Wound healing, sup-puration; two months in hospital. Final results, sinus at date of last observation, four and a half months later.

CASE XXIV.—Age and sex, male, twenty-three years. Variety of hernia, right inguinal. Date of operation, May, 1890. Suture material, silkworm gut. Wound healing, primary. Final results, two months

later sinus developed, and persisted seven months, when suture was removed; relapse shortly after.

CASE XXV.—Age and sex, male, forty-two years. Variety of hernia, right inguinal. Date of operation, July 22, 1895. Suture material, silk. Wound healing, in bed six weeks. Final results, persistent sinus; recurrence; second operation, October 5, 1895; suppuration; recurrence shortly after.

CASE XXVI.—Age and sex, male, thirty-one years. Variety of hernia, right inguinal. Date of operation, May, 1897. Wound healing, primary. Final results, nine weeks later sinus developed; some stitches removed; sinus was still present January 18, 1898, seven months later.

CASE XXVII.—Age and sex, male, sixty-five years. Variety of hernia, right inguinal. Date of operation, 1897. Suture material, silk. Wound healing, in hospital twelve days. Final results, sinus for one year.



FIG. 1.—Recurrent hernia following prolonged suppuration caused by non-absorbable buried sutures.

Fine catgut is employed by us for ligatures of arteries and for closing the skin incision. This will be found entirely absorbed when the first dressing is made at the end of one week. The catgut is prepared by boiling in absolute alcohol under pressure at a temperature of  $210^{\circ}$  F. Both the catgut and the kangaroo tendon that we have employed the past seven years have been prepared by Van Horn & Co., of New York. Frequent tests have shown them to be uniformly sterile. The dressings used have been, in most cases, pads of iodoform gauze and moist bichloride gauze (1:5000). A firm spica bandage is then applied, and over this a plaster-of-Paris spica, extending from the knee to the free border of the ribs. The plaster spica insures perfect rest for the wound, and we be-

lieve materially aids primary union, which has been obtained in 95.5 per cent. of the cases.

*Complications.*—In a few cases a small hæmatoma, due to imperfect control of all bleeding points, has developed after operation. In these cases the wound was slightly opened and the clots of blood pressed out, primary union following in two cases and suppuration in the third. Orchitis: In congenital hernia, especially if of large size, where the lower part of the sac has been sutured over the testis, there occurs occasionally a slight orchitis. The application of an ice-bag for one or two days always relieves this condition. In one case only did it go on to the formation of an abscess. Injury to cord: In but one case was the cord severed. Atrophy of the testis: One of the chief objections made to Bassini's operation, when it was introduced, was the supposed danger to the testis from transplanting the cord. The present series of cases, many of which have been under observation for four to seven years, enable us to say that the fear of this result is without foundation. In not a single case has atrophy been observed, either in children or adults. This is in striking contrast with the results of Halsted's operation. Dr. Halsted has seen several cases, and O'Connor, of Buenos Ayres, has observed 20 per cent. of atrophied testes in 129 cases operated upon by Halsted's method.—*Medical Press and Circular*, January 12, 1898.

*Inguinal Hernia in the Female.*—Forty-eight operations were for inguinal hernia in girls. The operative treatment of inguinal hernia in the female has received but little attention from most surgeons. Championnière was the first to urge it. His method was to excise the round ligament with the sac, but this we believe to be entirely unnecessary and not without objections. The method we have employed has been practically Bassini's method for the male, with the single step of the transplanting of the cord omitted. The incision through the aponeurosis is the same; the same tissues are included in the deep layer of sutures. The round ligament can, in all cases, be freed from the sac, and when

this has been done and the sac has been dissected high up beyond the internal ring, the sac is transfixed, tied, or sutured with catgut and excised; the ligament is allowed to drop back into its original place and the tissues are sutured over it. In the deep layer interrupted sutures of kangaroo tendon are employed, and in the aponeurosis a continuous suture of the same material.

It may be of interest to know that, including adults, we have operated upon 100 cases of inguinal hernia in the female. Of these 52 were adults and 48 children. Of the adults, 23

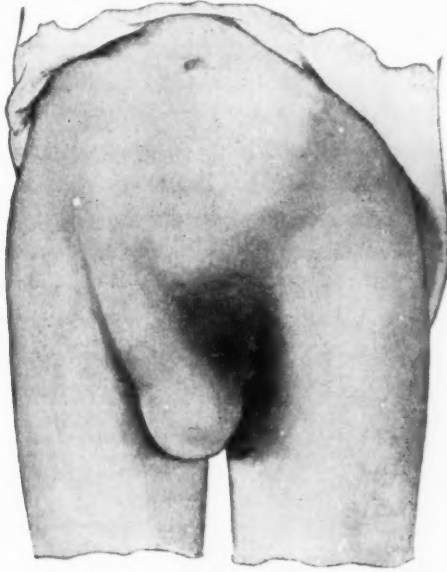


FIG. 2.—Inguinal hernia in labium majus.

were well upwards of two years; 15 from one to two years; 5 not traced; 8 operated on less than one year. Of children, 17 were well upward of two years; 26 over one year. Of the total number of female adults and children, 60 cases were well over one year; 40 cases were well over two years.

*Femoral Hernia in Children.*—Femoral hernia is very rare under the age of puberty. The writers have operated upon twenty such cases, the youngest being a boy, aged two years, with a double femoral hernia. In the sac of the right hernia was found the cæcum. In the majority of cases the operation



employed in children has been a high ligation of the sac and a closure of the femoral canal by means of a purse-string suture of kangaroo tendon. This suture is introduced first through Poupart's ligament, the outer part which forms the roof of the crural canal, then through the pectineal fascia and muscle, the fascia lata over femoral vessels, and, lastly, again upward through Poupart's ligament, coming out about one-fourth to three-eighths of an inch from the point of entrance. This brings the floor of canal in contact with the roof and completely closes the opening. It is very important to thoroughly free the sac before applying the ligature, in order that the stump may slip back into the abdominal cavity when cut off. This method has been employed by Dr. Coley in twenty-five cases, including adults, without a single relapse, and ten cases have been traced from two to six years. Bassini's method for femoral hernia has also been used by Dr. Coley in eleven cases. Since it has given no better results and is slightly more complicated, we believe the purse-string suture sufficient at least for femoral hernia in children, and the great majority of femoral hernia in adults.

It is not generally recognized, especially by physicians, that the results of operation in femoral hernia are so nearly perfect. Bassini (*Archiv für klinische Chirurgie*, 1894) has published a series of fifty-four cases operated upon by his own method, of which forty-one were traced from one to nine years without a single relapse. There was no mortality. The writers have operated upon ninety-four cases of femoral hernia. Of this number sixteen were well from two to six years, and thirty-four cases upward of one year. In non-strangulated cases there were but three relapses. One of these followed a Bassini operation, and was due to suppuration. The other two were cases in which the sac was excised without an attempt being made to close the femoral canal. One death occurred, due to shock and hæmorrhage, in a case of enormous irreducible femoral hernia, the size of a child's head. The omentum was injudiciously tied off *en masse*; the slipping of the ligature after the stump had returned into



the abdominal cavity, resulted in a severe hæmorrhage before the bleeding could be controlled. The patient died on the third day of shock and peritonitis. There are as yet few statistics from which to estimate the value of operations for femoral hernia aside from Bassini's: 54 cases with no deaths, and no relapses in 41 cases, traced from one to nine years. We have collected 241 cases, exclusive of our 94, with 3 deaths, in non-strangulated cases, but with little data as



FIG. 3.—Extraperitoneal lipoma, simulating umbilical hernia.  
(Operation by Dr. Carl Pfister.)

regards relapse. Küster operated upon 34 cases, with no relapses.

*Umbilical and Ventral Hernia.*—The results of our attempts at radical cure in these varieties of hernia have been, thus far, very disappointing. We have operated upon 34 cases (including cases operated upon in other hospitals) of umbilical and ventral hernia. Of these 19 were umbilical and 15 were ventral, including 3 epigastric and 11 herniæ following laparotomy, 4 of the latter followed appendicitis opera-

tions, in which the wound had been left open. Though these herniæ were of large size and adhesions were present in most cases, making the operation more or less difficult, no relapse has yet occurred. Of the total number of cases of umbilical and ventral, 12 relapses occurred in 21 cases traced; of this number 9 relapsed during the first year, and the majority of these during the first six months after operation.

Three of the cases of umbilical hernia were strangulated. Two recovered, thus showing a mortality of only  $33\frac{1}{3}$  per cent., which is very low for this condition.

In explanation of the large percentage of relapses in umbilical hernia, it should be said that the subjects were in most cases very unfavorable for radical cure. They were stout women, of middle age, with a thick layer of fat, and a correspondingly thin layer of muscular tissue in the abdominal wall. The operation was performed in most cases to relieve a condition that was the source of much pain and disability,—viz., a considerable mass of irreducible omentum that had become the seat of chronic inflammation, and which could not be rendered comfortable by a belt. While relapses occurred in the majority of cases, the condition was generally much improved over that prior to operation, and a support could be worn with a fair degree of comfort.

The results of operation in epigastric hernia have been very satisfactory, and the same is true, as has been stated, in hernia following appendicitis. In one case of this kind, a girl ten years of age, the operation for acute appendicitis had been performed two years before. In operating for the hernia, the appendix, about two inches long, was found buried in a mass of omentum, adherent to the old cicatrix.

The method of operation employed by us in this variety of cases has been free excision of all the cicatricial tissue, careful dissection, and exposure of the internal and external oblique muscular planes, with suture in separate layers with kangaroo tendon. One case, a very large hernia the size of a cocoa-nut, is now well, nearly two years, and the other three are all sound at present.

We have tabulated sixty-one cases of ventral hernia fol-

lowing operation for appendicitis. The great majority of these cases were operated upon during an acute attack, as shown by the history of the patients, as well as by the length of the incision and the long period of wound-healing. In most of these cases the incisions were upward of four inches in length, and few cases left the hospital in less than from four to six weeks. In most cases, where a clear history was obtainable, the hernia had developed within six months after operation. The size of the hernia and the consequent disability are of much interest. The herniæ ranged in size between that of an egg and a child's head. In many cases there



FIG. 4.—Large ventral hernia following median laparotomy.

was a bulging along the entire cicatrix rather than a distinct tumor. The weakness and discomfort caused by these herniæ are much the same as are found in hernia following median laparotomy. In regard to the treatment of such cases, we believe that much depends upon the age of the patient and upon the character of the abdominal wall. As a rule, these patients are young adults, with good abdominal muscles, with little accumulation of fat, conditions, the contrary of which usually obtain in umbilical hernia, and which so often contraindicate operation.

With herniæ sufficiently large to cause marked discom-

fort or disability, in view of the success we have already had in the cases we have personally operated upon, we would recommend operation.

*Ventral Hernia following Laparotomy.*—Three hundred and forty cases of ventral hernia following abdominal incision have been observed at the hospital during the past eight years. These cases have been tabulated, and from the tables the following points worthy of note have been gleaned: In 61 cases the hernia followed operation for appendicitis; in 25 it followed Alexander's operation.

As to the size of the hernia, which is, as a rule, a good

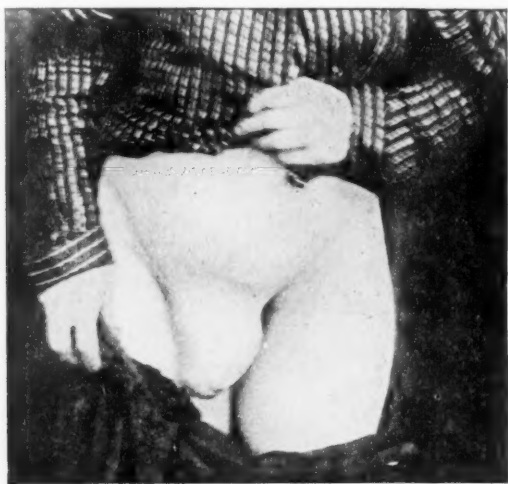


FIG. 5.—Ventral hernia following laparotomy.

guide to the amount of discomfort: In 28 cases it was the size of a child's head; in 25 cases it was the size of a fist; in 13 cases it was the size of a cocoa-nut; in 20 cases it was the size of an orange; in 30 cases it was the size of a goose-egg; in 45 cases it was the size of a hen's egg; in 35 cases it was of smaller size.

In regard to the time when the hernia developed: In 19 cases it appeared within one to two years; in 40 cases it appeared within six months to one year; in 95 cases it appeared within less than six months; in 18 cases it appeared over two years.

Inquiry made as to whether or not support was worn subsequent to operation, resulted as follows: In 129 cases a belt or bandage was worn; in 54, none.

*Methods of Operation and Wound-Healing.*—It was impossible from the history to ascertain the method by which the abdominal wall had been closed in these cases. As to wound-healing, the question of primary union can be fairly well determined by the duration of the patients' stay in the hospital: In 38 cases this was less than one month; in 118 cases this was from one to two months; in 74 cases this was from two to six months.

From this analysis the conclusion may be drawn that in the great majority of cases the wound healed by granulation, which confirms what we have already said as to the importance of primary union in hernia operations.

*Relapsed Hernia.*—Three hundred and sixty cases of relapse, following various operations for inguinal or femoral hernia, have been observed during the past ten years at the hospital. An analysis of these cases brings out the very important fact that the relapse occurred in the great majority of cases within a few months after operation. In 64.5 per cent. relapse occurred during the first six months; in 80 per cent., during the first year, and in only 20 per cent. after the first year; only  $8\frac{8}{9}$  per cent. relapsed during from one to two years. This enables us to say, in cases that have remained well beyond one year, that the chances of relapse are greatly diminished. These facts are in harmony with the time of relapse that has been noted in our own cases.

Of the cases that relapsed after two years, it may be noted that in five cases the period was between ten and twenty-two years; in seven cases between five and ten years.

A study of the cases as regards the age of the patients was made with the following results: In 3 cases the age of the patient was one to ten years; in 12 cases the age of the patient was ten to twenty years; in 38 cases the age of the patient was twenty to thirty years; in 47 cases the age of the patient was thirty to forty years; in 31 cases the age of the patient was forty to fifty years; in 29 cases the age of the

patient was fifty to sixty years; in 20 cases the age of the patient was sixty to seventy years; in 4 cases the age of the patient was seventy to eighty years.

Thus it will be seen that in 71 per cent. of the cases of relapse the age of the patient was over thirty years, and in 29 per cent. under thirty years. This fact is of little significance unless we know the relative number of cases operated upon over and under thirty years.

It should be stated that a distinction has been made in this analysis as to whether the operation was done for strangulated or for non-strangulated hernia. In 100 out of the 360 cases of relapsed hernia the operation was done for strangulated, though the average period of relapse after operation was found to differ little in the strangulated and non-strangulated.

Thirty-one cases were femoral and 329 inguinal. Of the femoral, 19 were strangulated and 12 reducible.

*Rare Forms of Hernia.*—Of the 400 cases in children operated upon at the hospital, in 19 cases the cæcum and appendix alone or together were found in the sac. In nine cases the appendix was present. In eight cases it was adherent to the sac by more or less extensive adhesions. The question whether to remove the appendix in such cases or to free the adhesions and return it to the abdominal cavity is one of some importance. The plan adopted by the writers has been to return the appendix if the adhesions were slight, and to remove it if extensive. In five cases the appendix was removed and in four it was returned into the abdominal cavity. In one case, that of a boy, aged seven years, a long adherent appendix was found in the sac of a left inguinal hernia; while in another case, that of a boy, two years of age, the cæcum was found in a right femoral hernia. All the cases were under ten years of age, and eight under five years.

Operation in cæcal hernia offers less favorable conditions for permanent cure, for the reason that the sac cannot be closed so high up nor so satisfactorily as in the ordinary cases. This is due to the fact that in congenital hernia of the cæcum, especially in children, the hernia is formed by a

sliding down of the cæcum together with the peritoneum lining the iliac fossa, due to the traction of the gubernaculum. Hence, in a fully developed hernia of this kind, the cæcum will be found to bear the same relation to the sac that it formerly did to the peritoneum of the iliac fossa. In operating upon a rupture of this kind no complete sac is found, and we must separate the attachment of the cæcum posteriorly, and return it into the abdominal cavity, suturing as well as possible the peritoneum in front. The final results of our nineteen cases show one relapse. This case was operated upon for an earlier relapse, and, in consequence of prolonged suppuration at the first operation, extensive adhesions were present. Relapse again occurred in a year. The other cases have remained well, all but one having been traced.

*Strangulated Hernia in Children.*—Seven cases have been operated upon during this period for strangulation. Six of these cases were under two years of age, and four under one year. There was no mortality, although several of the cases were in a desperate condition at the time of operation. These cases have only recently been reported (*Archives of Pediatrics*, April, 1898) in detail, and will be merely mentioned at this time. Strangulation in infants, while undoubtedly rare, has occurred sufficiently often to justify us in calling attention to it. It is most important to be able to make an early diagnosis, and to advise proper treatment, the diagnosis having been made. The condition most likely to give rise to confusion in diagnosis is hydrocele of the cord. The history of the case and the general condition will, however, invariably enable one to differentiate the two.

*Hernia following Alexander's Operation.*—Twenty-five cases have been observed of hernia following Alexander's operation for shortening the round ligaments. In six cases the hernia varied in size from that of a goose-egg to that of a cocoa-nut.

In nearly all the cases the symptoms caused by the uterine displacement were unimproved. With one exception the herniæ all appeared within one year after operation, and in seventeen cases within six months. These cases are not

reported as evidence against the value of Alexander's operation, but simply to call attention to the possibility of resulting herniæ, especially if the wounds fail to heal by first intention.

*Undescended or Partially Descended Testis.*—This condition is frequently seen in boys, and is usually associated with a small hernia.

The question of operation in such cases is a very important one, and one which, at present, cannot be looked upon as definitely settled.

We have operated upon fourteen cases of this kind. An effort has been made to draw down the testis and to anchor



FIG. 6.—Interstitial hernia, with undescended testicle.

it in the scrotum, but, thus far, such efforts have met with little success. While we have had no relapse from the hernia, the small testis has been retracted into the vicinity of the external ring, and has either shown no further development or has undergone further atrophy.

From this limited operative experience, and from extended observation of a very large number of cases treated mechanically, we are at present inclined to advise against operation in the majority of such cases. If left alone or treated with a truss with the pad resting above the testis, in most cases the testis will have reached the scrotum before puberty, and the rupture will probably have been cured. If



not, an operation can then be performed under more favorable conditions.

*Cases in which Operative Treatment is Advised.*—(a) *Children.* (1) Cases over four years of age, in which a truss has been given a fair trial without marked improvement, as evidenced by the rupture frequently coming down, or by never being completely controlled.

(2) Cases complicated by fluid in the hernial sac (reducible hydrocele), which renders it impossible to effect a cure by mechanical means.

(3) Irreducible herniæ (rare in children).



FIG. 7.—Large inguinal hernia in a boy, aged ten years.

(4) Femoral herniæ in children which, though rare, cannot be cured by trusses.

We have seldom found it necessary to operate upon children under four years of age, and we believe the practice of some surgeons of operating upon infants under one year open to serious question.

Umbilical hernia in infants and children should, with very rare exceptions, never be operated upon, for the reason that they are almost invariably cured before the age of puberty, either spontaneously or by mechanical support.

Our own series of 400 cases treated by operation have been carefully selected from upward of 8000 cases of hernia in children.

(b) *Adults.* (1) It may be stated in a general way that

the younger the patient the more favorable the prognosis as regards radical cure.

(2) Inasmuch as a cure by means of a truss is but rarely obtained, after the age of maturity, operation may be properly advised in all cases of young adults. The operation is attended with little risk in competent hands, and the prospect of cure is extremely good.

(3) All cases of irreducible omentum if the hernia be not too large and the subject not too old, are best treated by operation.

(4) All cases of femoral hernia in patients suitable for operation.

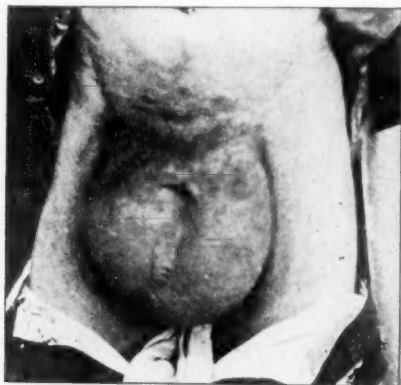


FIG. 8.—Double inguinal hernia, operation contraindicated.

*Contraindications.*—Operation should seldom be advised in patients over sixty years of age.

Very large irreducible hernia, especially in stout persons, should not be operated upon. The risks are great, and the prospect of cure very small.

*Choice of Methods.*—At present the evidence is very strongly in favor of the superiority of Bassini's method. This method was first performed by its author in 1884, and introduced to the profession in 1890. Supported as it was by a series of 251 cases, with but one death and seven relapses, all but four cases having been traced, it was quickly adopted by many surgeons, both in Europe and America. This method, as stated, gained in favor until, at present, it may be

safely said that it is more generally employed than any other. The results of this method in the hands of other surgeons have equalled those obtained by Bassini himself.

Halsted's method, while it closely resembles that of Bassini, differs in the direction of a more complicated technique, which alone would be sufficient reason for choosing Bassini's method, provided the results were the same. As a matter of fact, the published results of Dr. Halsted, though excellent, are inferior to those of Bassini. The free cutting of the internal oblique muscle in Halsted's operation we regard as a serious defect. The cut edges can never be accurately approximated. This step is entirely unnecessary in

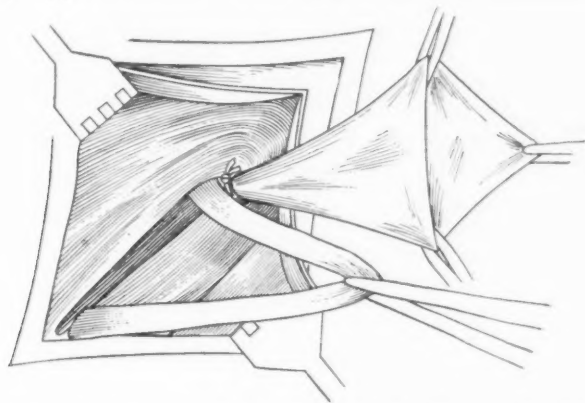


FIG. 9.—Showing sac can be freed beyond neck without cutting internal oblique muscle. (Original, from life.)

Bassini's operation, as shown by the accompanying drawing. The time required to perform Bassini's operation is much less than that for Halsted's.

The brilliant results of Macewen have not been generally obtained by other surgeons attempting to operate by his method.

The transperitoneal method recently introduced by Dr. Geo. R. Fowler may, in certain cases, be preferable to other operations, but the method is yet too recent to pass judgment upon.

The method which we have employed in a considerable number of cases, and which we have designated as "suture

of the canal without transplantation of the cord," the remaining steps being identical with Bassini's, has, we believe, much to commend it, though as yet our cases are too few in number to enable us to estimate its comparative value. That particular feature of any method which allows the sac to remain behind to be disposed of in various ways, either intra- or extraperitoneally, we believe, should be given up. Such disposition of the sac undoubtedly lessens the chances of securing primary union, and does not, we think, offer any additional security against relapse. The practice followed by some surgeons of using a number of different methods must be condemned for the reason that it is impossible to attain the same proficiency in all that could be obtained in one. Success is dependent in no small degree upon rapidity in operating which permits of the least amount of bruising the tissues, thereby contributing to primary union.

*Results of Operation.*—There is no longer room for doubt that hernia can, for a considerable period at least, be cured by operation. Whether these cures will prove permanent we cannot, as yet, state positively. The proportion of permanent cures cannot be estimated with exactness, inasmuch as no definite limit of time can be laid down beyond which relapse may not occur. In spite of this, we are able, from a careful study of the cases operated upon up to the present time, to arrive at certain fairly definite conclusions. The results of our observations, based upon a study of 360 cases of relapsed hernia following various methods of operation, already referred to, throw valuable light upon the question as to the period when relapse is more likely to occur. We have found that 80 per cent. of these relapses occurred during the first year after operation; 64.5 per cent. during the first six months following operation; while but 11.9 per cent. occurred after a period of two years had elapsed. Of the cases that relapsed after two years, five occurred between ten and twenty-two years after operation; seven cases between five and ten years. These cases, which were not selected, but taken as they applied for treatment, ought to give us a fairly accurate idea of the average time when relapse occurs.

From these facts we are justified, we think, in concluding in a general way that, if a rupture is sound at the end of one year after operation, there is reasonable prospect of permanent cure; while if it remains well for two years, the chances of relapse are exceedingly small, though it is not impossible that relapse may occur as late as twenty years after operation.

Roux, of Lausanne, Switzerland, has operated upon 1398 cases, with five deaths. Of these 324 were traced beyond two years, and 54, or 16.7 per cent. of this number, relapsed. Two hundred and thirty-five of the cases traced were operated upon by the method of Ferrari; only 53 by the method of Bassini, slightly modified by Roux, in that he substituted a purse-string suture for the interrupted suture of Bassini. Of the 53 cases operated upon by this method, 35.8 per cent. relapsed. A study of the wound-healing of these cases is of much interest: Of the cases that healed by primary union 15.2 per cent. relapsed; of the cases that healed by secondary union 22.4 per cent.

Halsted has operated upon 309 cases, with one death. Of 221 cases operated upon by his own method, there were twelve relapses. It is stated that in five cases in which relapse occurred there was an obliteration of the conjoined tendon.

Macewen (personal communication) has operated upon 224 cases by his own method, with two deaths. Of this number 107 were traced with five relapses, and 93 cases well from two to ten years after operation.

Broca, of Paris (personal communication), has operated upon 1064 cases by his own method, with nine deaths; a very large proportion of these cases were children. The number of cases traced is not stated.

As regards the mortality following modern methods of operation for the radical cure of hernia, we have collected 8594 cases operated upon during the past decade, with 78 deaths, showing a mortality of less than 1 per cent.

*Results of Operations for the Radical Cure of Hernia performed by the Writers.*—We have together operated upon 1051 cases since 1888, or during the past decade. Of these 522 were operated upon by Dr. Bull, 531 by Dr. Coley. Of

Dr. Bull's cases 96 were children under fourteen years, while of Dr. Coley's 365 were children under fourteen years, and 166 adults, or persons between fourteen and seventy years of age. Of Dr. Bull's cases 170 were operated upon by Bassini's method. Of Dr. Coley's cases 448 were operated upon by Bassini's method. Of these 137 were in adults or persons between the ages of fourteen and seventy years, and 311 in children under fourteen years. All of Dr. Coley's cases were operated upon between August, 1891, and September, 1898. One hundred and thirty-four cases were operated upon by Dr. Bull prior to 1890, and a comparison of these earlier results in which the Czerny and Socin methods were employed, with the later cases operated chiefly by Bassini's method, is of great interest, and will suffice to show the great superiority of the latter method.

Of the 134 cases operated upon prior to 1890, only 49 per cent. healed by primary union; 40 per cent. relapsed within two years after operation, and most of these relapses occurred during the first year after operation. It should be noted that of the 134 cases only 16 were in children under fourteen years of age.

In regard to the suture material, silk was used in twelve cases, and in every case traced a sinus developed after a longer or shorter interval after operation, remaining open until one or more sutures were finally discharged or removed. The silk was prepared by boiling in a 5-per-cent. carbolic acid solution just before using it.

The mortality of the early series (three deaths) was considerably higher than that in the later cases. One death was caused by ligature of the omentum too close to its attachment to the bowel; one died of hæmorrhage and one of peritonitis.

Of the total number of cases, 1051, 921 were inguinal, 96 femoral, 19 umbilical, and 15 ventral: 100 of the cases were inguinal hernia in females; 461 were children between four and fourteen years of age; 590 over fourteen years.

*Methods of Operation.*—Bassini's method was employed in 618 cases with twelve relapses. Of these cases 371 were

children under fourteen years of age, with three relapses, or  $\frac{3}{4}$  of 1 per cent.; 247 adults over fourteen years, with nine relapses, or 3.7 per cent. In the 80 cases in which the cord was not transplanted, but in which the other steps of the technique were the same as in Bassini's method, there were four relapses.

*Wound Healing.*—Of 531 cases operated upon by Dr. Coley since 1891, 95.5 per cent. healed by primary union.

Mortality of new series, operated upon since 1890, was five deaths in 917 cases, or  $\frac{2}{5}$  of 1 per cent. One death was due to hæmorrhage from large omental stump in an enormous femoral hernia; one was due to ether pneumonia; one to acute peritonitis; a fourth to pneumonia, pericarditis, and supuration of wound in a very weakly child suffering from spinal disease; the fifth was in an irreducible cæcal hernia in a child aged twenty months, and death was apparently due to shock. Only three of the deaths followed Bassini's method. Four were in children and three in adults.

*Final Results.*—Of the 917 cases operated upon since 1890, 295 were traced and found free from recurrence for periods varying from two to seven years after operation, 486 cases were well upward of one year after operation.

#### GENERAL STATISTICS.

Operator, Roux, of Lausanne, personal communication. No. of cases, 1398. Mortality, five deaths. Results, 324 traced beyond two years; 54 relapsed,— $16\frac{7}{10}$  per cent.

Operator, Broca, Paris, personal communication. No. of cases, 1064. Method, own. Mortality, nine deaths.

Operators, Bull and Coley. No. of cases, 1042. Method, Massini's, 621. Mortality, eight deaths. Results, 500 well + one year; 290 well two to eight years; twelve relapses from Bassini's operation.

Operator, Bassini, personal communication. No. of cases, 550. Mortality, five deaths. Results, 247 traced.

Operator, Championnière, personal communication. No. of cases, 475. Method, own. Mortality, four deaths. Results, seventeen relapses; 141 traced.

Operator, Halsted, Johns Hopkins Bulletin, May, 1898. No. of cases, 309. Method, own. Mortality, one death. Results, twelve relapses in 221 cases of own method, well over two years (?).

Operator, Rushton Parker, British Medical Journal, 1896. No. of cases, 250. Method, Macewen's operation in 100 cases. Mortality, eight deaths.

Operator, Delorme (Paris), Archives de Médecine et de Pharmacie militaire, 1894, 1895, 1896. No. of cases, 250. Mortality, two deaths.

Operator, Marcy, personal communication. No. of cases, 224. Method, own. Results, eleven relapses; No. of cases traced (?).

Operator, Degarmo, Journal of the American Medical Association, 1897. No. of cases, 250. Method, Bassini's. Results, four relapses.

Operator, Kocher. No. of cases, 280. Method, various methods and own. Mortality, one death. Results, fifteen relapses; 174 traced.

Operator, Massapust. No. of cases, 199. Mortality, four deaths.

Operator, Schede. No. of cases, 163. Mortality, one death.

Operator, Socin, Deutsche Zeitschrift für Chirurgie, Vol. xxiv and later. No. of cases, 147. Mortality, one death.

Operator, Macewen, personal communication. No. of cases, 224. Mortality, two deaths. Results, 107 traced; ninety-three well two to ten years; five relapses.

Operator, Felitzet. No. of cases, 105. Method, own. Mortality, one death.

Operator, J. B. Deaver. No. of cases, 100. Mortality, one death.

Operator, E. Laplace. No. of cases, 125. Mortality, one death.

Operator, Nicalodoni. No. of cases, 100. Mortality, one death.

Operator, Salgren Hospital. No. of cases, 140. Mortality, two deaths.

Operator, Czerny, Beiträge zur klinische Chirurgie, 1896, Vol. xvii, pp. 537-57. No. of cases, 105. Mortality, two deaths. Results, sixty-eight traced, one and a quarter to six and a half years. Nine relapses, —13.24 per cent.

Operator, Berger. No. of cases, 128. Mortality, one death.

Operator, Billroth. No. of cases, 136. Mortality, seven deaths prior to 1880.

Operator, Küster. No. of cases, 86. No mortality.

Operator, Ferrari. No. of cases, 78. No mortality.

Operator, United States army surgeons, collected by J. M. Banister. No. of cases, 67.

Operator, Austrian army surgeons (Ibid.). No. of cases, 103. Mortality, one death.

Operator, Neve. No. of cases, 55. Mortality, one death.

Operator, O'Hara. No. of cases, 60. No deaths.

Operator, O'Connor, Medical Press and Circular, January 12, 1898. No. of cases, 129. Method, Halsted's. No mortality.

Operator, Hospital, Trousseau, Paris (Gordon) Beiträge zur Chirurgie, Lotheisen, 1898. No. of cases, 250. Mortality (?).

Operator, Barker, British Medical Journal, September 10, 1898. No. of cases, 200. Mortality, three deaths. Employs silk sutures. In twenty-one out of 200 cases buried silk sutures came away. Bassini's method was used in 57 cases; Kocher's in 7; Macewen's in 2, and Barker's own method in 79. Ten operations were for femoral hernia and thirteen for ventral.

Total No. of cases, 8594. Mortality, 78 deaths. Results, mortality, nine-tenths of 1 per cent.



## POSTERIOR THORACOTOMY FOR FOREIGN BODY IN THE RIGHT BRONCHUS.<sup>1</sup>

By B. FARQUHAR CURTIS, M.D.,

OF NEW YORK,

PROFESSOR OF CLINICAL SURGERY AND ADJUNCT PROFESSOR OF THE PRINCIPLES OF  
SURGERY IN THE UNIVERSITY AND BELLEVUE HOSPITAL MEDICAL COL-  
LEGE; SURGEON TO ST. LUKE'S HOSPITAL, AND TO THE  
NEW YORK CANCER HOSPITAL.

ONE of the most serious accidents which can befall man is the entrance of a foreign body into the bronchi through the glottis. It is true that there are some cases in which the foreign body has returned by the same route, and many more in which it has been removed by a deep tracheotomy. There are even a few instances of survival of the patient for years with the foreign body impacted in the bronchi, the patient's health being sometimes but little affected, while in other cases chronic suppuration has resulted. Weist has shown that the mortality of the entrance of foreign bodies into the air-passages in general left untreated is 29 per cent., and that when a deep tracheotomy is done it is still 25 per cent., showing that operation to be but slightly better than nothing. Preobraschensky gives the mortality from a foreign body in the bronchi as 55 per cent. Until very recently it was supposed that the extraction of the foreign body through the deep tracheotomy wound was the only possible means of relief. But in 1888 Nasiloff proposed to open the chest by resection of the ribs posteriorly, for the purpose of reaching the œsophagus, a method further developed by Potarca and by Quénu and Hartmann, and in 1895 Joseph D. Bryant recommended a similar method for the removal of foreign

<sup>1</sup> Read before the New York Surgical Society, May, 1898.

bodies from the bronchi. Meanwhile Rushmore, in his well-known case, had planned to open the chest anteriorly in order to reach the bronchus, but afterwards gave his preference to the posterior operation. Willard and Potarca made a series of experiments upon dogs, the former opening the pleura widely and the latter employing the posterior operation, with equally poor results, these animals presenting peculiar difficulties to the Nasiloff operation, on account of the thin pleura. I am not aware of any attempt having been made to put Bryant's suggestion into practice before my own case in 1896.

In October, 1896, E. G., a boy, eleven years of age, entered my service at the Post-Graduate Hospital with the following history: He was a country lad of unusually good physique. Three days before admission he had been playing with the seed-vessel of some plant (perhaps the berry of the mountain ash), an object ovoid in shape, measuring three-eighths of an inch in its long diameter, and nearly as much transversely, with a smooth, firm shell, through which an ordinary pin had been passed. He was holding this in his mouth, and, by a deep inspiration, accidentally drew the seed-vessel, transfixing with the pin, through the glottis into the trachea. In spite of violent coughing, emetics, inversion, and succussion, etc., the foreign body had remained impacted in the bronchus.

An examination of the chest, on admission, revealed a beginning consolidation at the base of the right lung, indicating which bronchus was occluded. Owing to the loss of the temperature-chart I am unable to give the pulse and temperature record, but my recollection is that the temperature was slightly elevated, about 100° F., and that the pulse was nearly normal.

On the fourth day after the accident, under chloroform anæsthesia, a tracheotomy was done as low as possible, and curved forceps introduced, by which the foreign body was readily found in the right bronchus, two inches beyond the bifurcation, and could be grasped, but all attempts at extraction were in vain. A wire uterine curette was sharply bent near the end, and could be passed beyond the foreign body, but the latter remained immovable. The point of the pin was evidently directed upward

and caught in the wall of the bronchus, resisting all efforts to dislodge it. After working for about an hour, the patient was put to bed.

That evening I rehearsed on the cadaver an operation similar to Bryant's, and the following day, having gained full consent from the boy's father, I proceeded as follows:

*Operation.*—Chloroform anæsthesia. The patient was turned over upon his face, one shoulder resting upon a sand-bag, so as to render respiration easier. A quadrangular flap was raised from the posterior surface of the chest, with its base outward at the scapula, and its free edge near the vertebral spines of the fourth, fifth, and sixth dorsal vertebræ. (The tips of the dorsal spines are on the same level as the angles of the ribs attached to the corresponding vertebræ.) This flap comprised the skin and fascia, and the aponeurosis of the trapezius, and was reflected outward. Some fibres of the rhomboid and of the serratus posticus were divided, and these muscles were then retracted outward, while the splenius was retracted inward, and the transverse processes of the vertebræ being exposed, the attachments of the longissimus dorsi were separated from them, and all the deep muscles were detached from the ribs and retracted outward. Portions of the fourth, fifth, and sixth ribs, about three inches in length, were then resected subperiosteally from the tuberosities outward. The layer made up of the periosteum and intercostal muscles was then carefully divided so as not to injure the pleura, the intercostal arteries being secured as they were severed. The pleura was carefully but widely detached from the contents of the posterior mediastinum and from the posterior chest wall so as to give access to the root of the lung. The bronchus was easily reached, but it was difficult to expose it, so as to enable an incision to be made into it, on account of the azygos vein which crossed it. The respiratory movements of the lung, heaving under the detached pleura, were also very embarrassing, and, finally, as the pulse began to be affected seriously, the wound was packed and the operation suspended.

The following day the packing was removed, chloroform being given again, and the pleura being now somewhat adherent to the lung and the latter less troublesome, the bronchus was successfully opened on its posterior wall without hæmorrhage.

But even then our difficulties were not completely surmounted, for, to our great disappointment, it was found to be impossible to recognize the foreign body with the forceps introduced into this opening. The foreign body, partly macerated, was similar in consistency to that of the bronchial forks, and it appeared to be farther away from the bifurcation of the trachea than at first. Forceps were also passed down through the tracheal wound, but still the foreign body was not to be found. Finally, it was detected through the lung by pressing upon the latter with the fingers, and it was determined to cut directly down upon it, as even then no forceps could be made to pass to the spot where it lay. The detached parietal pleura was first secured to the surface of the lung by two or three deep silk sutures, the ends of the latter being left long, and the lung being held steady by the threads, an incision was made with the thermocautery knife. The foreign body could be felt in this opening, but it still eluded the grasp of forceps, and the condition of the patient forbade any further delay, so a drainage-tube was introduced to the bottom of the opening made in the lung and the entire wound packed. Whether the pin was too firmly fixed in the wall of a bronchus, or whether some tissues still remained undivided over it, was impossible to determine; but if the patient had survived, it is probable that the foreign body would have found its way out of the deep wound which led directly down to it. The patient reacted well, and on the following day showed only the ordinary symptoms of a severe pneumonia. Signs of consolidation had been present in the lower lobe of the right lung from the first, and these had increased daily. Fever and dyspnoea, due to this consolidation, gradually increased, and terminated in death about forty-eight hours after the last operation. A post-mortem examination showed no pneumothorax and no pleural effusion. The foreign body lay in one of the secondary bronchi close to the end of the drainage-tube, the pin having entirely penetrated the wall of the bronchus.

The fatal termination of this case was evidently not altogether due to the traumatism of the operation, but to the pneumonia set up by the foreign body, which had already been in place three days when the child was first brought, and the heroic treatment of three prolonged operations under

anæsthesia, with the necessary restriction in food. As to the last, I should add that rectal feeding was employed and as much fluid food as possible was given in the intervals. The operation was so new that it had to be worked out as we went along, and the delays were unavoidable in this first case.

In another case I would make only half a dozen efforts to reach the foreign body through a tracheotomy wound, and then turn the patient over at once and proceed with the posterior operation. With suitably shaped, wide retractors the lung could easily be held so that its motions would not be embarrassing, and the bronchus could be reached in one sitting.

A few words as to the technique of the operation. The European operators open the mediastinum by making a longitudinal incision of considerable length half way between the scapula and the spinous processes, with linear division of the ribs, or the removal of only an inch or so of bone, depending upon strong retraction to widen the gap in the thorax. Bryant uses a flap with its base towards the spine and its free edge along the scapula, and resects a portion of the central rib of the three to be divided, then makes a double division of the two ribs above and below, leaving the intermediate portion of each of these ribs attached by the soft parts, and turns these small osteoplastic flaps upward and downward, to be replaced at the end of the operation. I turned my flap in the other direction with its base towards the scapula, because the base was then thicker than the free edge, the reverse being true of Bryant's flap, which cuts through the trapezius at the scapular edge, and in its base has left only the thin aponeurosis. Of great advantage is the fact that the flap attached to the scapula at its base moves with that bone and gives a very free exposure of the wound. No important nerves or other structures are divided in either way of making the flap. The amount of bone removed from the three ribs operated upon appears to be of no great moment, and Bryant's osteoplastic resection would probably lengthen an operation already very complicated,

and even reduce the room to be obtained in the wound. In the young patient upon whom I operated abundance of room for entering the chest was obtained by the removal of three inches from each of the three ribs.

The securing of the pleura to the lung and the incision to reach the foreign body are, to my mind, preferable to too prolonged attempts to pass instruments through the bronchi. The frequent bifurcation of the bronchi makes it rather difficult to introduce a forceps with any certainty in a given direction, and it is especially difficult to get the forceps to enter the posterior branches, even when, as in this case, the foreign body could be felt through the lung tissue.

In case of incision of either bronchus or lung, the wound should always be drained and packed, because of the quantity of mucus which will pour out of the respiratory passages. The fluids escape by the drain, and the packing shields the sides of the wound from infection by them. The external flap could be easily secured by secondary suture after granulation has started in the deeper wound.

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Nasiloff, quoted by Potarca (original Russian); and an abstract in ANNALS OF SURGERY, 1888, Vol. iii, p. 308.  
Potarca, Roumanie médicale, Bucharest, 1894, Vol. ii, p. 116.  
Preobraschensky, Wiener Klinik, 1893, p. 191.  
Quénu and Hartmann, Bulletins et Mémoires de la Société de Chirurgie, Paris, 1891, p. 82.  
Rushmore, New York Medical Journal, July, 1891, Vol. liv, p. 85.  
Weist, Transactions of the American Surgical Association, 1882, Vol. i, p. 125.  
Willard, Ibid., 1891, Vol. ix, p. 345.

THE ANATOMY AND SURGERY OF THE FRONTAL SINUS AND ANTERIOR ETHMOIDAL CELLS.<sup>1</sup>

By HOWARD A. LOTHROP, M.D.,

OF BOSTON,

ASSISTANT IN ANATOMY, HARVARD UNIVERSITY.

PART I.

A STUDY OF THE ANATOMY OF THE FRONTAL SINUS AND ANTERIOR ETHMOIDAL CELLS.

METHOD OF INVESTIGATION.

THIS opportunity is taken to express my great indebtedness to Professor Thomas Dwight, of Harvard University, not only for the unlimited privileges necessary to carry on this investigation, but also for many valuable suggestions.

About 125 subjects, or 250 frontal sinuses, obtained from dissecting-room material, form the basis of this research. They were inspected when obtained, and preserved in alcohol for future study and reference.

Fifty of these specimens were macerated, after examination, in the natural state, and about fifty more bony specimens have been accessible for study.

The parts have been examined from sagittal, coronal, and horizontal sections, and also by dissection of especial regions, the use of probes, injection of fluids, etc.

The accompanying plates were made from photographs taken by Bernard W. Trafford, Esq., of Boston, whose assistance and skill were invaluable in adding to the success of the

<sup>1</sup> This work was awarded the Warren Triennial Prize for the year 1898, by the physicians and surgeons of the Massachusetts General Hospital.

work. These photographs were taken from specimens selected as seemed necessary to demonstrate the anatomy under consideration, hence the relations are an exact reproduction. The size of the specimen reproduced in the plate is not altered, except in a few obvious instances.

The aim of the anatomical portion of this paper is not to describe accurately and completely any one or more bones, but only the necessary portion of any bone entering into the topography of the region to be considered.

#### THE FRONTAL SINUS.

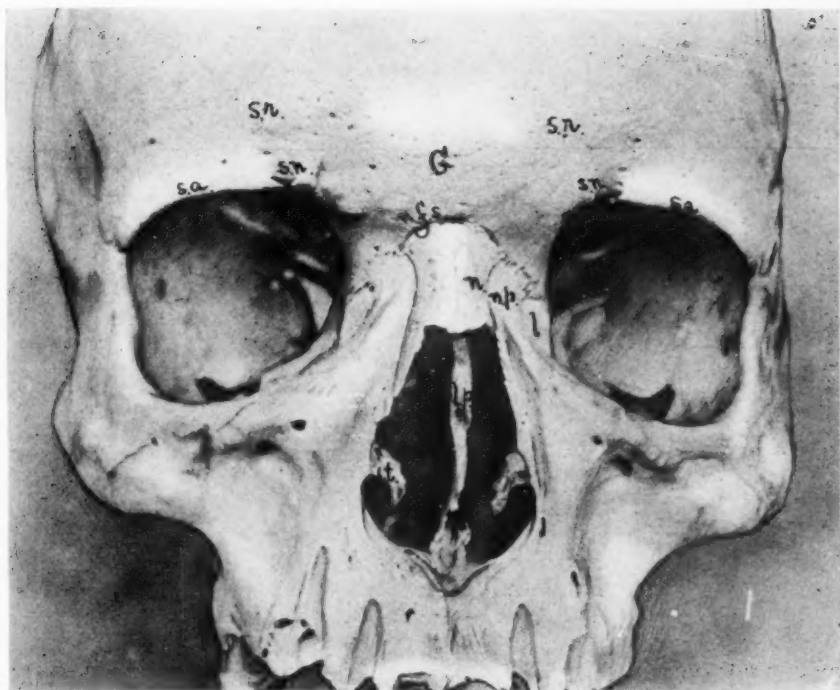
The frontal sinuses are two cavities situated, for the greater part, in the frontal bone, one on either side of the median line, and anterior to the ethmoidal notch. No matter how small the sinuses may be, they will be found at the antero-internal junction of the horizontal (orbital) and vertical (squamous) portions of the frontal bone, just internal to the internal angular process. (Plate 1.) Thence, according to their development, they may extend for a variable distance between the laminae of these portions of the frontal bone, as will be described in detail.

Each sinus may be considered as the space formed by the intersection of four planes, and assumes roughly the form of a three-sided pyramid, and presents the following points for examination: Three surfaces—anterior, posterior, internal—and a base,—inferior surface. (Plates 20, 53, 54, 56, 60.) All surfaces are roughly triangular. Of the several borders, three deserve particular mention,—anterior, superior, and posterior. Three angles are prominent,—superior, external, and posterior.

*Anterior Surface.*—The anterior surface is situated entirely in the vertical portion of the frontal bone, and is bounded below by the supraorbital arch (Plate 1), internally by the median line, generally represented by a partial suture at its lower part, but the superior limit of this surface is very variable, and has no external landmark. The surface as a whole is somewhat convex from side to side, and more



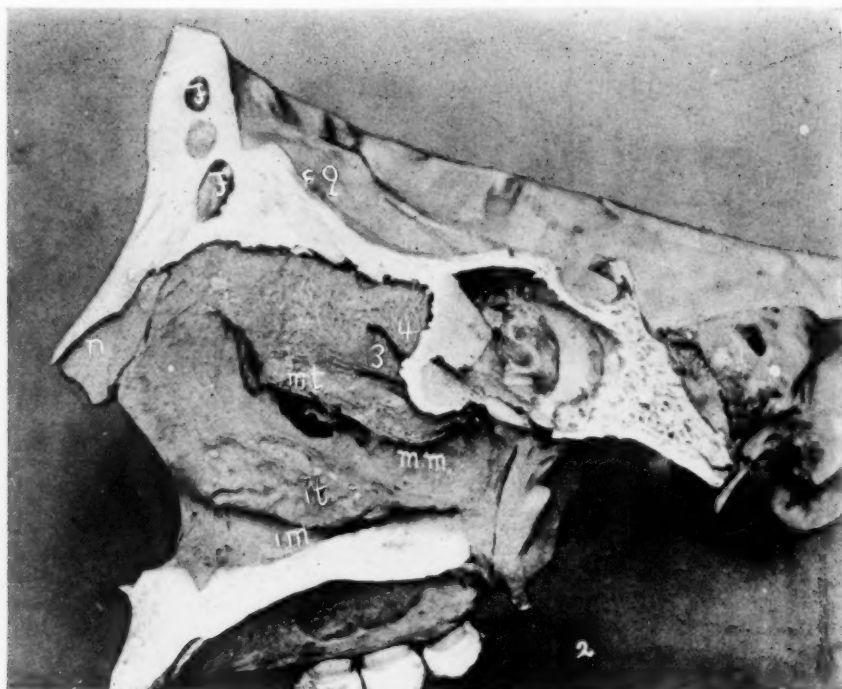
Plate 1.



ANTERIOR VIEW OF SKULL.

*g.* Glabella or nasal eminence. *s.r.* Superciliary ridge. *s.a.* Supra orbital arch. *s.n.* Supra orbital notch or foramen. *n.* Nasal bone. *n.p.* Nasal process of superior maxillary bone. *l.* Lacrymal bone. *n.f.s.* Naso-frontal suture. *i.t.* Inferior turbinate bone. *l.p.* Lamina perpendicularis.

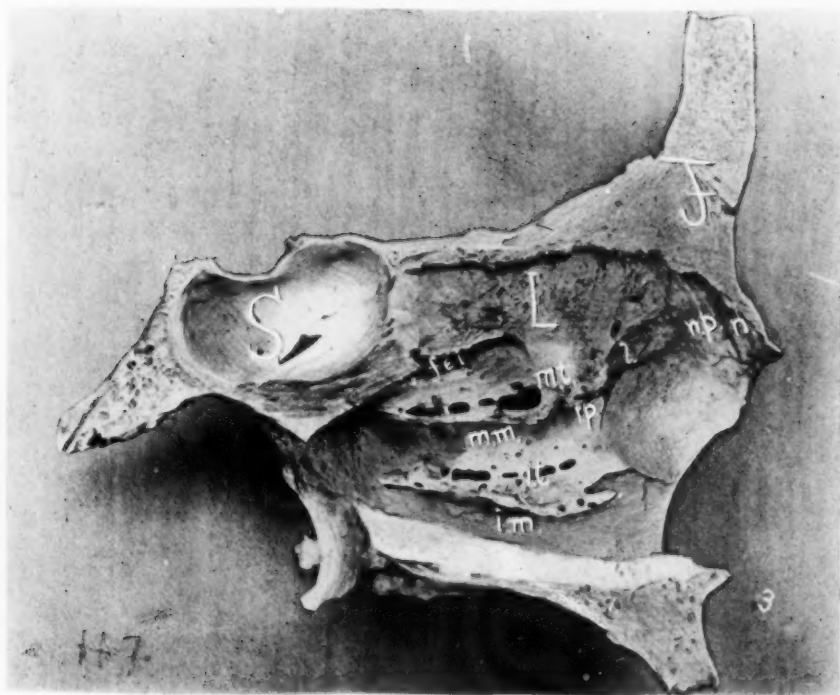
Plate 2.



SAGITTAL SECTION TO RIGHT OF NASAL SEPTUM, SHOWING LATERAL WALL OF NASAL FOSSA. TURBINATE BONES UNDISTURBED.

F. Frontal sinus. S. Sphenoidal sinus. *i.t.* Inferior turbinate bone. *m.t.* Middle turbinate bone (inferior ethmoidal turbinate bone). *3* and *4*. Middle and superior ethmoidal turbinate bones. *c.g.* Crista galli. *n*. Nasal bone. *i.m.* Inferior meatus. *m.m.* Middle meatus.

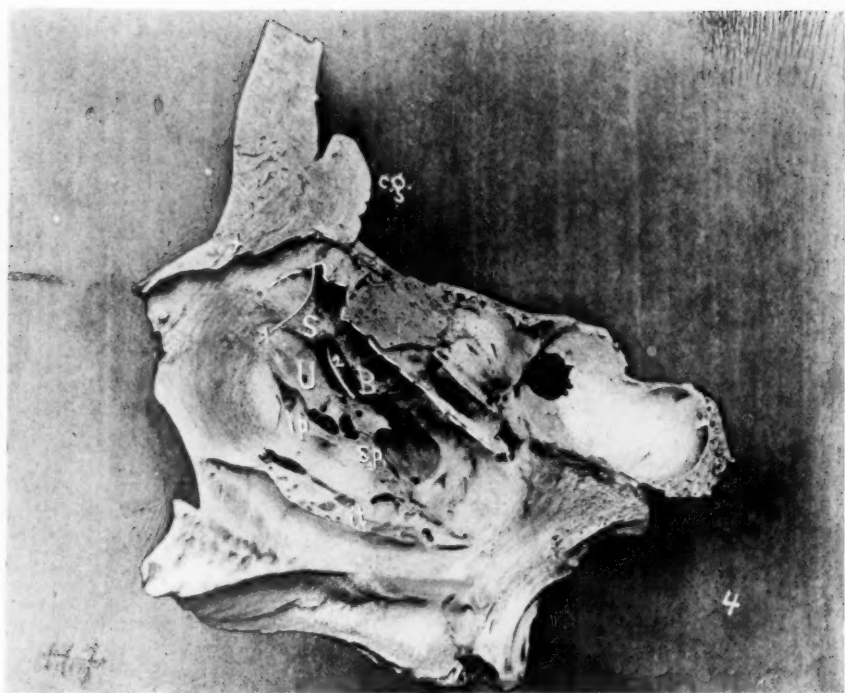
Plate 3.



BONE. LEFT NASAL FOSSA, EXTERNAL WALL, SHOWS ATROPHY  
OF BONE IN AGED.

*i.t.* Inferior turbinate. *m.t.* Middle turbinate. *S.* Sphenoidal sinus. *i.m.* Inferior meatus. *m.m.* Middle meatus. *f.e.i.* Fissura ethmoidalis inferior. *L.* Internal wall of lateral mass. *n.p.* Nasal process of superior maxilla. *l.* Lachrymal bone. *l.p.* Lachrymal process of inferior turbinate bone. *n.* Nasal bone. *F.* Frontal bone.

Plate 4.



BONE. RIGHT NASAL FOSSA, EXTERNAL WALL, MIDDLE TURBinate BONE  
REMOVED ALONG DOTTED LINE.

*f.* Nasal process of frontal bone. *i.t.* Inferior turbinate. *l.p.* Lachrymal process of inferior turbinate. *c.p.* Ethmoidal process of inferior turbinate. *U.* Uncinate process of ethmoid bone. *B.* Bulla ethmoidalis with its ostium just above. *S.* Septum between Uncinate process and Bulla. *1.* Probe passed into frontal sinus through turbinate fossa. *2.* Probe passed through Hiatus Semi-lunaris, into Infundibulum to Anterior Ethmoid Cells. *c.g.* Crista galli.

so vertically, on account of the superciliary ridges which traverse it from below upward and outward, and serve, to a certain extent only, as a guide to the location and size of the sinus. The superciliary ridges meet in front at the nasal eminence or glabella, which is a useful landmark for the surgeon. The surface, as a whole, is rather smooth and covered with minute foramina, leading to cancellated tissue. This is the thickest of the four surfaces, and varies from one millimetre to six millimetres in thickness in different places, according to age, sex, and race, although about two millimetres to three millimetres would be a fair average. This sinus wall is apt to be thicker in the vicinity of its boundaries and at the most prominent part of the superciliary ridge.

The anterior surface measures the height and width of the frontal sinus, and is consequently very variable. Laterally, the sinus may extend only occasionally to the external angular process of the frontal bone. An average of 200 sinuses, measured from the median line laterally, lie between two centimetres and two and eight-tenths centimetres, and this shows that it is not safe to trephine for the sinus external to the supraorbital notch or foramen. The height of the sinus is given as the measure of the internal border of the anterior surface, close to the internal surface, from the base to the apex of the pyramid. This will average one and eight-tenths centimetres to two and one-half centimetres, and this is usually the highest point of the sinus.

Above the superciliary ridge the smooth surface of bone is uninterrupted, but below we come to the sharp supraorbital arch, thick and generally notched, which terminates at the internal angular process of the frontal bone. The lower border of this surface is then fixed by the suture between the frontal bone, on the one hand, and the nasal bone and the nasal process of the superior maxillary bone, on the other hand. Where the nasal eminence is very prominent the lower portion of the anterior surface looks somewhat downward as well as forward. (See plates of sagittal sections.)

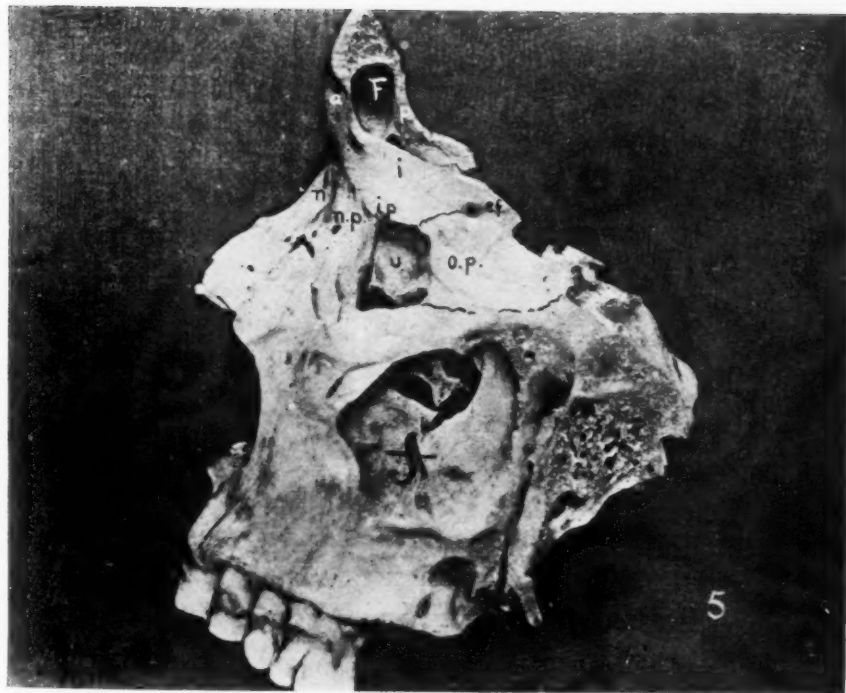
Anterior to this surface of the frontal bone are certain

facial muscles, supraorbital and frontal arteries, and supra-orbital and supratrochlear nerves, all directly under the skin, which is loosely connected to the deeper parts by the superficial fascia. None of these structures should offer any hindrance to the surgeon in making any incision whatever over the region of the frontal sinus.

*Posterior Surface.* (Plates 51, 53, 60, 67, sagittal sections.)—The posterior surface belongs in part to both the vertical and horizontal portions of the frontal bone, and is much thinner than the anterior surface. The vertical portion is somewhat convex towards the sinus, as is also the horizontal portion, if the sinus is small, but where the sinus extends laterally between the laminae of the orbital portion (Plates 65, 71), then this posterior surface of the sinus becomes concave in conformity with the general arch of the roof of the orbit. Posteriorly this surface forms part of the wall of the anterior cranial fossa, and is in contact with the frontal lobe of the brain and along its inner border with the olfactory lobe. Just anterior to the ethmoidal notch the two posterior surfaces come together in the median line, forming with the ala processes of the ethmoid bone the foramen cæcum, whence ascends the frontal crest. (Plate 57.) The upper and outer boundaries of the posterior surface of the frontal sinus, as viewed from within the skull, are not defined, but the internal border, moreover, follows the frontal crest as far as the foramen cæcum, is reflected around the crista galli, and then follows the lateral border of the cribriform plate (lamina cribrosa). (Plates 16, 17, 76.) The posterior surface of the frontal sinus becomes horizontal in its orbital portion, and is continued as the roof of the anterior and then the posterior ethmoidal cells. (Plates 51, 77.)

This posterior wall of the frontal sinus is dense and brittle, and contains no diploe, but sections of the anterior wall often show more or less cellular structure between two layers of more dense bone. (Plate 10.) As compared with the posterior wall, the anterior is tougher and more likely, up to a given point, to bend them to fracture. Sections of the

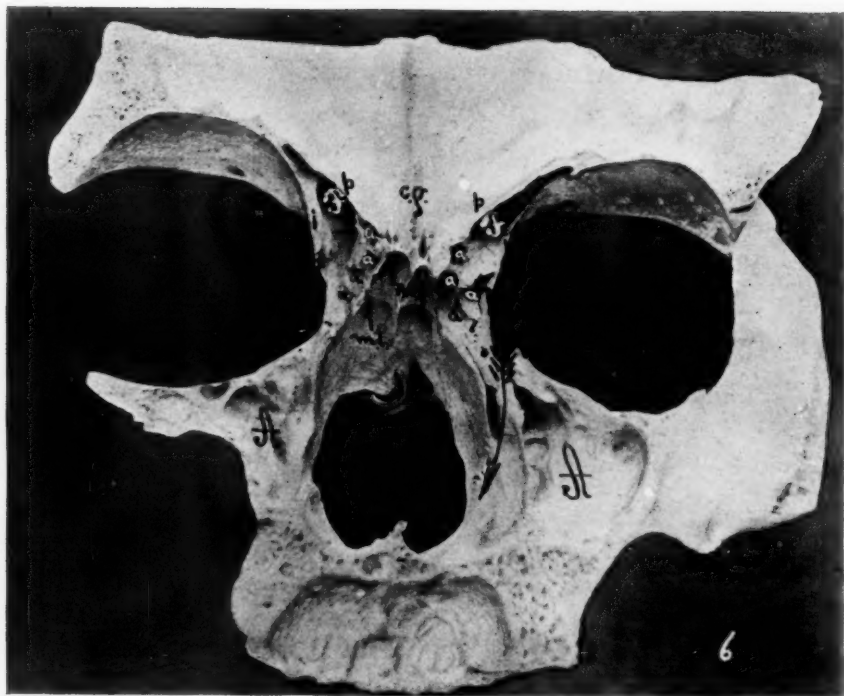
Plate 5.



BONE. LEFT ORBITAL FOSSA, INNER WALL, LACHRYMAL BONE REMOVED.

*o.p.* Os Planum. *ef.* Anterior ethmoidal foramen. *F.* Frontal sinus. *a.* Its anterior wall. *p.* Its posterior wall. *i.* Orbital portion of its inferior wall. *n.* Nasal bone. *n.p.* Nasal process. *A.* Inner wall of Antrum of Highmore. *i.p.* Internal angular process of frontal bone. *U.* Uncinate process.

Plate 6.

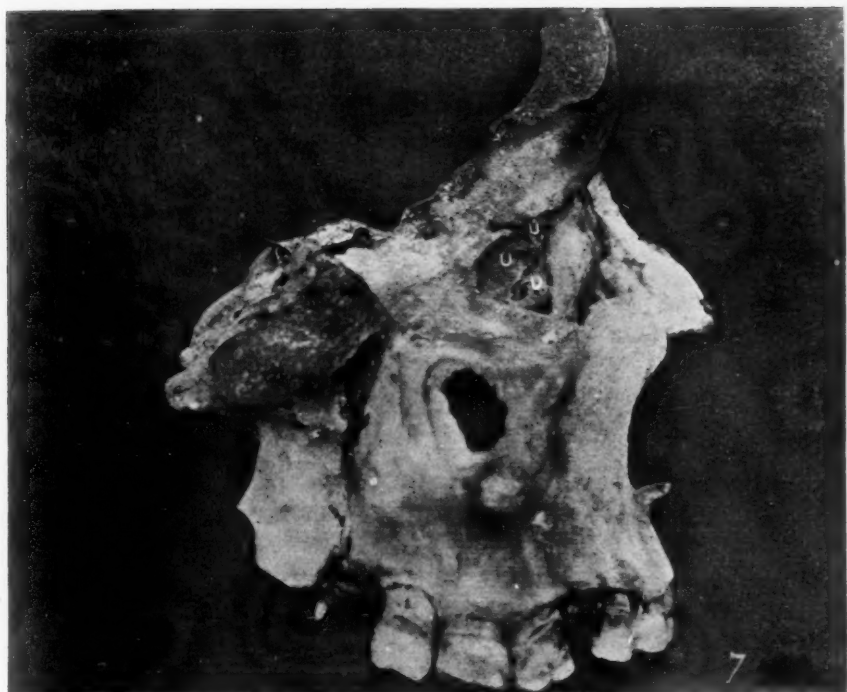


BONE. CORONAL SECTION THROUGH POSTERIOR ANGLES OF FRONTAL SINUS  
LOOKING INTO THE SINUS FROM BEHIND.

F. Frontal sinus. *p.* Its posterior wall. *i.* Its inferior wall. *c.g.* Crista galli. *n.s.* Small portion of nasal septum. *A.* Antrum. *m.t.* Line of insertion of anterior extremity of the left middle turbinate on the nasal process of the superior maxilla. *a.a.a.* Anterior ethmoidal cells. Arrow showing course of nasal duct.



Plate 7.



INTERNAL WALL OF LEFT ORBITAL FOSSA WITH LACHRYMAL BONE REMOVED,  
SHOWING UPPER PORTION OF UNCINATE PROCESS AND BONY SEPTA,  
WHICH COMPLETE CERTAIN ANTERIOR ETHMOID CELLS  
WHEN THE LACHRYMAL BONE IS IN SITU.

*u.u.u.* Uncinate process, and incomplete ethmoid cells.

Plate 8.



BONE. RIGHT NASAL CAVITY, EXTERNAL WALL, MIDDLE TURBinate BONE  
REMOVED ALONG DOTTED LINE.

B. Ethmoid Bulla. U. Processus Uncinatus. m. Its maxillary process.  
l. Lachrymal bone. f.e.i. Fissura Ethmoidalis Inferior. i.t. Inferior turbinate.  
1. Probe through turbinate fossa to frontal sinus. 2. Probe through Hiatus Semi-  
lunaris and infundibulum to anterior ethmoid cells situated between lachrymal  
bone and upper extremity of Uncinate process. f. Nasal process of frontal bone.  
A. Agger Nasi. s. Septum between Uncinate and Bulla. np. Nasal process of  
superior maxilla. im. Inferior meatus.

vertical portion of the frontal bone show that the diploe ceases rather abruptly (Plates 5, 9) at the junction of the posterior and anterior surfaces (superior border), although, as just mentioned, the anterior surface is somewhat cancellated. If the vertical portion of the frontal sinus is wanting, the two lamellæ of bone are more nearly approximated, and the intervening space filled with cancellated bone. Hence a careful operator would observe the presence of this diploe, in case the sinus was not developed, and avoid entering the cranial cavity. (Plates 3, 4.)

*Internal Surface.*—Situated between the two sinuses is a thin lamina of bone, easily perforated by a sharp-pointed instrument, either side of which serves as the internal surface of its corresponding sinus. The inferior border of this septum is usually near the median line, and is continuous with the plane of the crista galli, the perpendicular plate of the ethmoid, and the nasal spine of the frontal bone. This border is considerably thickened, passes off laterally to form a dense portion of the inferior surface or base of the sinus, and is continued below in the median line at the nasal spine. (Plates 9, 13, 56, 60, 62, 76.)

In the majority of cases this septum deviates to one side or the other within a range of five millimetres, or even more, notwithstanding its frequent median position inferiorly. Its surface is usually convex near its centre, with a corresponding concavity on the other side, unless, as occasionally happens, the septum is very thick and the sinuses are small, then both surfaces are concave. (Plate 64.) The sinuses become divergent towards their apices, so that the upper portion of the septum is much thicker than its centre.

The plane of the septum is roughly antero-posterior, passing between the anterior and posterior surfaces, but occasionally it may be so deviated that one sinus lies partly overlapping the other, even to an extent of two centimetres. This is a point of obvious surgical importance. With remarkable constancy, on account of its often delicate structure, this septum is usually complete, so that there is no

communication between the sinuses. An examination of 180 specimens has revealed two examples, one an oval perforation near the centre of the septum, the other, its almost entire absence. (Plate 55.)

*Inferior Surface* (floor or base of the sinus). (Plates 13, 15, 16, 57, 61, 65, 71.)—The inferior surface is divisible into an orbital and a nasal portion.

The orbital portion lies external to the nasal portion, enters into the formation of a part of the roof of the orbital fossa, and its extent is open to considerable variation according to the size of the sinus. Its surface is markedly convex laterally towards the sinus, and but slightly so in the antero-posterior direction. (Plate 54.) It is triangular, limited in front by the supraorbital arch, internally by the suture between the frontal bone, on the one hand, and the os planum (lamina papyracea) of the ethmoid bone and the superior border of the lachrymal bone, on the other. (Plates 5, 20.) There is nothing on the roof of the orbit to indicate its posterior extent. This layer of bone forming the orbital portion of the floor of the sinus is the inferior of the two laminae into which the orbital portion of the frontal bone divides as it approaches the ethmoidal notch; the superior lamina, moreover, goes to complete a portion of the posterior surface of the sinus. The outer portion of this inferior lamina is nearly horizontal, but as it approaches the median line it turns a sharp angle downward so as to be vertical at its termination. (Plate 20.) The under surface is smooth and marked anteriorly by a slight depression or small tubercle of bone for the cartilaginous pulley of the superior oblique muscle. (Plate 13.) The sinus aspect of this lamina is likewise smooth, but is frequently roughened by the presence of septa connected with the sinus or anterior ethmoidal cells, to be described in detail later.

In front, this surface usually extends laterally a little beyond the supraorbital notch, frequently one centimetre farther, and occasionally as far as the external angular process of the frontal bone. (Plate 71.) Posteriorly its inner

border frequently reaches the anterior ethmoidal foramen (Plate 5), and in rare instances it may nearly approach the lesser wing of the sphenoid bone. Such a sinus would be very large. With the exception of the thin walls of the ethmoidal cells, which in part complete the nasal portion of the floor of the sinus (Plate 16), the orbital portion is the thinnest of all the sinus walls. This is evident, not only from inspection of the bone, but also from the result of pathological changes consequent on obstruction of the ostium frontale. Internally the plane of the inferior orbital lamella is continuous with the lachrymal bone and the os planum of the ethmoid, so as to form the internal boundary of the orbital fossa, and the external boundary of the lateral mass of the ethmoid bone (Plate 20), indeed, from a surgical point of view a portion of the lateral boundary of the nasal fossa. This general curvature must be constantly kept in mind by the operator when entering the sinus or anterior ethmoidal cells from in front. Although not mathematically constant, the general curvature is so regular, and its direction and contour so uniform, that this lamella serves as the guide for the surgeon in avoiding the orbital fossa.

The nasal portion of the inferior surface or floor of the sinus is somewhat complicated, but a thorough understanding of its composition and relations is of great surgical importance. It is a comparatively small surface, and well defined only in selected cases. Its surface is very uneven and interrupted by the rounded eminences of ethmoidal cells, bony septa from different directions, and the presence of a foramen of varying size and shape which leads into the nasal fossa. (Plates 15, 16, 17.) These features may almost obscure the surface, particularly behind, where it passes into the posterior angle of the sinus. It is a surface of greater surgical than anatomical importance, hence its consideration will be dwelt upon at length.

In general, by the nasal portion of the floor of the frontal sinus we mean the irregular, somewhat horizontal surface which separates the sinus from certain ethmoidal cells and

other portions of the ethmoid bone, internal and at right angles to the plane of the lachrymal bone and os planum. (Plates 20, 72, 76, 79.) It terminates in front, at the line of suture, between the frontal bone and the nasal process of the superior maxilla, externally it joins the orbital lamina of the frontal bone, internally it does not reach the septum nasi in the median line, but is arrested at the line of junction of the internal wall of the lateral mass of the ethmoid with the cribriform plate of the same. (Plates 13, 17, 79.) This internal wall of the lateral mass is the upward prolongation of the lower ethmoidal turbinate (commonly called the "middle turbinate"), and is carried forward so as to continue the internal boundary of the nasal portion of the floor of the sinus by articulating with the ethmoidal crest of the superior maxilla. (Plates 2, 3.) This internal border of the nasal portion of the floor is completed in front by a small portion of the thickened frontal septum as it is continued into the nasal spine. (Plates 11, 15.) Posteriorly the nasal portion of the floor is lost in the posterior angle of the sinus. (Plate 76.)

On viewing the under surface of the frontal bone, an irregular opening is observed which leads to the right or left frontal sinus respectively, and is known as the hiatus frontalis. (Plates 13, 15.) Following the circumference of the hiatus frontalis, we have in front the articulation of the nasal process of the superior maxilla, externally the lachrymal bone and os planum along the free edge of the inferior orbital lamella, internally the frontal septum, behind which we come to the ethmoidal notch formed by the two superior orbital laminae. (Plates 14, 15, 16.) Hence, between these two orbital laminae in front is an opening, the hiatus frontalis, while posteriorly the intervening space is interrupted by septa forming cavities which help to complete certain of the anterior and posterior ethmoidal cells when the frontal bone is *in situ*. (Plate 13.) This inferior aspect of the hiatus frontalis, and the area immediately posterior to it, gives one the best idea of what is meant by the nasal portion of the floor of the frontal sinus. The ethmoidal notch is filled by the crib-

Plate 9.



BONE. INNER WALL, RIGHT ORBIT, LACHRYMAL BONE REMOVED.

*F.* Frontal sinus. *a.* Superciliary ridge on anterior wall. *p.* Posterior wall. *i.* Inferior wall, at internal angular process of frontal bone. *n.* Nasal bone. *n.p.* Nasal process of superior maxilla. *u.u.u.* Uncinate process with septa and incomplete ethmoidal cells. *m.* Maxillary process of uncinat, closing ostium maxillare. *l.* Turbinate process of uncinat. *o.p.* Os Planum. *c.* Nasal canal. *A.* Internal wall of Antrum.

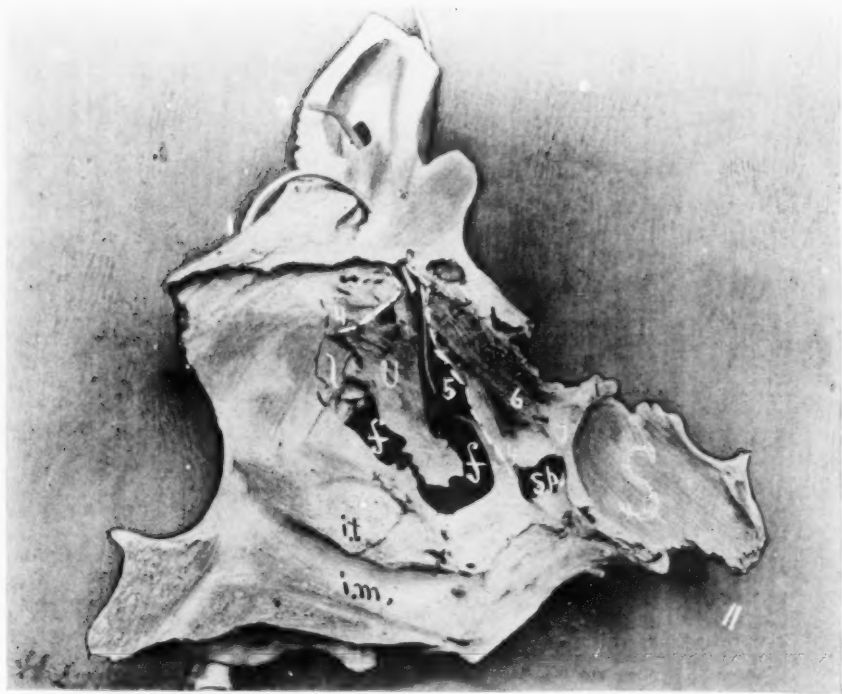


BONE. LEFT NASAL FOSSA, EXTERNAL WALL, MIDDLE TURBINATE REMOVED ALONG DOTTED LINE, AND ALSO THE LACHRYMAL BONE REMOVED, (1).

1. Probe through turbinate fossa to frontal sinus. 2. Probe through Hiatus Semi lunaris and Infundibulum to anterior ethmoid cells, situated between uncinat process and bulla ethmoidalis. 1. Space completed by nasal aspect of lachrymal bone, forming thereby a portion of the bony external wall of the nasal fossa. U. Uncinate process (Fig. 2 on its maxillary process). B. Ethmoid Bulla, its ostium just above. i.t. Inferior turbinate. s.p. Its lachrymal process. c.p. Its ethmoid process. A. Agger Nasi. F. Frontal sinus, with septa. c.g. Crista galli hollowed out by a diverticulum. S. Sphenoidal sinus. s.p. Spheno-palatine foramen. a.a. Bony fontanelles leading to Antrum. v.m. Ostium maxillare. s. Septum between Uncinate and Bulla. n. Nasal bone. n.p. Nasal process of superior-maxilla. 3 and 4. Middle and superior turbinate bones of the ethmoid.



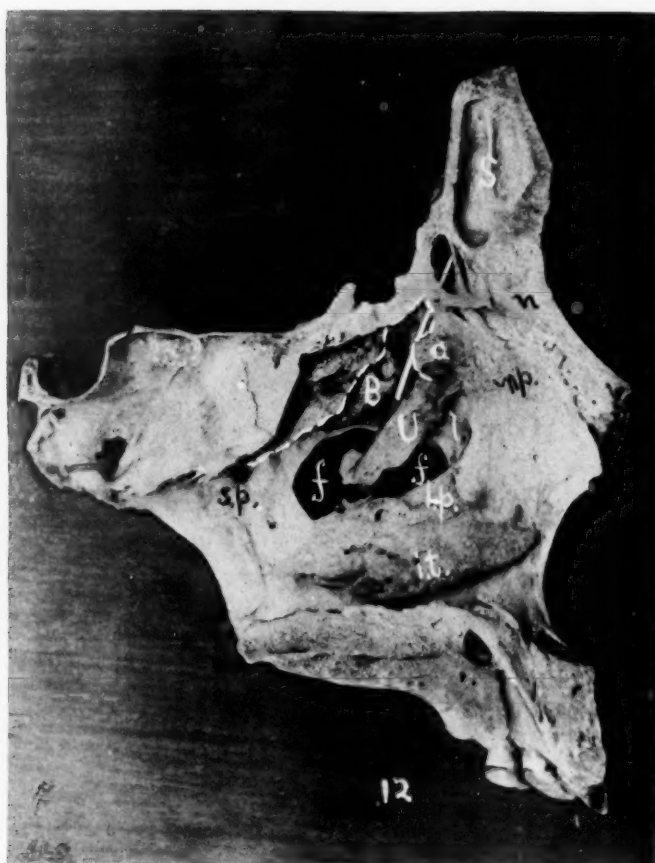
Plate 11.



BONE. NASAL CAVITY, EXTERNAL WALL, MIDDLE TURBinate REMOVED. SEPTUM BETWEEN UNCINATE PROCESS AND ETHMOID BULLA WANTING SO THAT THE TURBinate FOSSA AND UPPER END OF INFUNDIBULUM ARE ONE CAVITY.

1, 2, 3. Probes in divisions of right frontal sinus leading to the cavity common to the turbinate fossa, and upper end of Infundibulum. *f.f.f.* Dotted line marking insertion of middle turbinate. 5. Small Ethmoid Bulla. 6. Superior turbinate. 7. Spheno-ethmoidal recess. *U*. Uncinate process. *L*. Lachrymal bone. *S*. Sphenoidal sinus. *i.t.* Inferior turbinate. *s.p.* Spheno-palatine foramen. *i.m.* Inferior meatus. *f.f.* Fontanelles leading to Antrum.

Plate 12.



BONE. LEFT NASAL CAVITY, EXTERNAL WALL, MIDDLE TURBinate REMOVED ALONG THE DOTTED LINE. NO SEPTUM BETWEEN UNCINATE PROCESS AND ETHMOID BULLA, SO THAT TURBinate FOSSA AND UPPER END OF INFUNDIBULUM ARE ONE CAVITY, INTO WHICH OPENS THE FRONTAL SINUS, AS SHOWN BY PROBE.

*s.* Septum between frontal sinuses. *B.* Ethmoid Bulla. *U.* Uncinate process. *a.* Agger Nasi. *i.t.* Inferior turbinate. *f.f.* Fontanelles to Antrum. *s.p.* Sphenopalatine foramen. *l.* Lachrymal bone. *l.p.* Lachrymal process of inferior turbinate. *n.* Nasal bone. *n.p.* Nasal process of superior maxilla.

riiform plate, whence descends in the median line the perpendicular plate of the ethmoid bone (*lamina perpendicularis*). The cribriform plate forms a portion of the true anatomical roof of the nasal fossa, is internal to the hiatus frontalis and apices of ethmoidal cells (Plates 16, 17), roughly parallel with the nasal surface of the frontal sinus, yet on a little higher plane. Again, looking at the inferior surface of a frontal bone (Plate 13) with the cribriform and perpendicular plates in position, we have a space averaging from one centimetre to one and eight-tenths centimetres wide between the free edge of the inferior frontal lamina to the *lamina perpendicularis*. This space is divided by a third parallel lamina, which is simply the upward continuation of the inferior ethmoidal turbinate to its insertion on the *lamina cribrosa*, and its anterior prolongation to the ethmoidal crest of the superior maxilla. The outer space is occupied by the nasal floor of the frontal sinus in front, behind by the anterior ethmoidal cells. (Plates 20, 58, 62, 65, 74, 77, 79.) The internal space, somewhat narrower, is roofed over by the *lamina cribrosa*, and, although a dangerous locality, this additional space is of value in the operative treatment of diseases of the frontal sinus and anterior ethmoidal cells.

Further consideration of the floor of the nasal portion of the frontal sinus must be deferred until a portion of the ethmoid bone has been described.

The anterior border of the frontal sinus is formed by the junction of the anterior and inferior surfaces, and follows the line of the supraorbital arch. (Plates 1, 53.) These surfaces meet at an angle somewhat greater than 90 degrees, so that this border is rounded rather than sharply defined.

The superior border follows the line of union of the superior and posterior surfaces, which usually meet at a rather acute angle, so that this border is well marked. (Plates 51, 54.)

The posterior border follows the line of separation of the orbital laminae as they diverge to become the inferior and posterior surfaces of the sinus. Towards the external angle

this border is usually unobstructed (Plate 54), but, as it approaches the internal angle (Plate 53), the narrow space between the orbital laminae is filled up with one or more bony cells of variable size, which protrude forward into the sinus so as to diminish its size, often to a considerable degree. These cells, together with those at the posterior angle, are so intimately associated with the anterior ethmoidal cells that they will call for a more detailed account later.

The superior angle is the apex of the sinus, lies in the vertical portion of the frontal bone, and offers nothing of particular interest.

The external angle is sharp and corresponds to the most lateral portion of the sinus. Its location, like that of the superior angle, varies according to the size of the sinus.

The posterior angle is usually filled with cells and is of much surgical importance. It will be better understood in connection with the nasal floor of the sinus and the anterior ethmoidal cells.

Other borders and angles exist which call for no particular mention.

#### GENERAL CONSIDERATIONS.

*External Appearances.*—There are no absolutely certain guides by which the degree of development of the frontal sinuses in the adult can be determined before attempting to expose them. At birth, the frontal bone is in two portions, the sinus has not yet appeared, and the frontal eminences are prominent. As the child grows the sinuses develop slowly and the general shape of the head and frontal region changes. At puberty, the sinuses are practically developed and the frontal area has assumed its adult form. The gradual appearance of the superciliary ridges, which are apt to be most marked over the sinuses and the nasal eminence, make the supraorbital area of the adult more prominent, and the frontal eminences less so when contrasted. In general, it is fair to conclude that the more prominent the supraorbital area, including both the superciliary ridges and nasal eminence, the greater the probability of the presence of well-

defined sinuses. (Plates of sagittal sections.) Even fairly well-marked superciliary ridges on a non-protruding supra-orbital area are frequently accompanied by poorly developed sinuses or even absence of their vertical portion. (Plate 6.)

Race characteristics have some influence, as shown by poor sinus development in receding frontal bones.

Sinuses in the male appear to be relatively larger than would seem to be warranted by the usual disproportion between the measurements of the bones in general of the male and female skeleton. This may be but a part of the general accentuation of eminences and depressions in the male sex, particularly in the vicinity of joints.

Transillumination of the unopened sinus on the cadaver after the removal of the calvarium, transmitting the light from below towards the cranial cavity, is a good guide for determining, approximately, both the size of the sinus, its presence or absence, and the thickness of the walls. The value of transillumination in determining these points and also the presence of exudate within the sinus in practice will be considered in Part II.

The relative thickness of the sinus walls has been considered, but the actual thickness is influenced more or less by age, sex, and race. The walls are somewhat thicker in the male, where the bones in general are heavier, and in races characterized by well-developed bones. Bones of the aged may lose a third of their weight by absorption, whereby bony laminae become much thinner and more brittle. The size of the sinus may be thereby somewhat increased, but to no very appreciable extent.

*Occurrence.*—With very great regularity both sinuses are present. Several anatomists are authority for the statement that one or both sinuses may be absent without indicating whether the whole sinus or its vertical portion was meant.

A sagittal section, made so as to pass through the nasal portion of the inferior surface, shows that the sinus, as a whole, is flattened from before backward, and curved upon itself so as to present an anterior convexity. (Plates 9, 51,

52.) The superior part of the sinus lies within the vertical portion of the frontal bone, the posterior part is in the orbital portion, and the most prominent part of the convexity is at the anterior border, which follows the line of the supraorbital arch. (Plates 10, 11, 36.)

An examination of about 250 sinuses has given these results:

(1) That in no instance has the orbital portion been wanting, although it may be much diminished in size, and correspond to an anterior ethmoidal cell. There has always been an orbital space communicating with the middle meatus, either indirectly through the infundibulum, or directly by an ostium under the anterior line of insertion of the lower ethmoidal turbinate, in conformity with one of the usual modes of communication between the nose and frontal sinus.

(2) That in about 3 per cent. of the cases the frontal sinus does not reach to the vertical portion of the frontal bone, at least on one side. From a surgical stand-point such a sinus may be said to be wanting, for the diagnosis and treatment of suppuration in a small orbital sinus would not differ materially from such a condition present in the anterior ethmoidal cells.

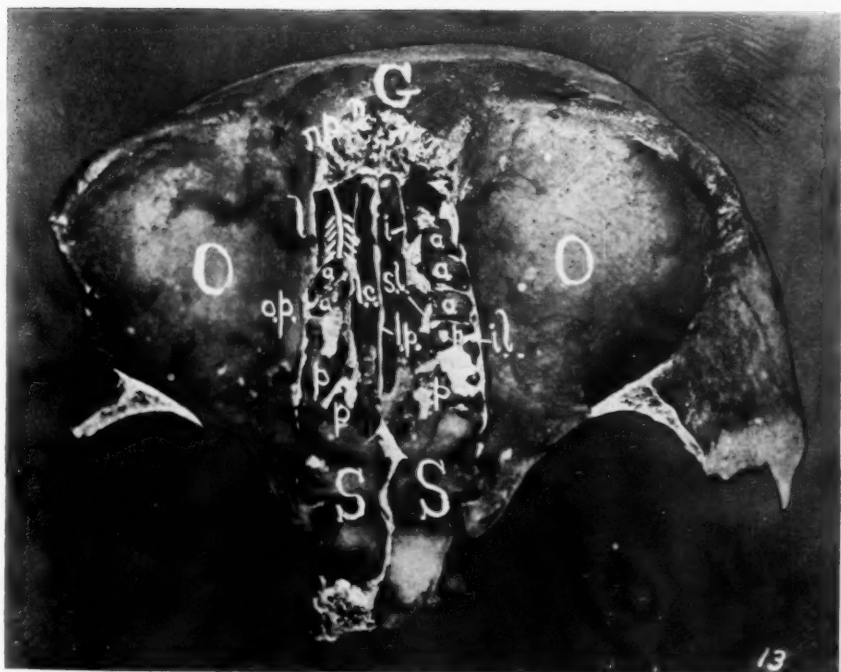
(3) That a sinus may be of ordinary size on one side and abortive on the other. (Plate 63.)

(4) That the sinuses of the two sides are never precisely alike.

(5) That the sinus of each side opened into the corresponding nasal cavity, with one exception.

(6) That in one case the frontal sinuses were of more than average size; that there was no trace of a median septum except a slightly elevated ridge corresponding to its periphery; that on the left side of the median line there was no ostium frontale, but on the right side there was one ostium frontale in the usual location, serving as an outlet for this large common sinus into the right nasal cavity. This abnormal condition will be described later. (Plate 55.) The pyramidal shape of the sinus can be made out in most cases

Plate 13.

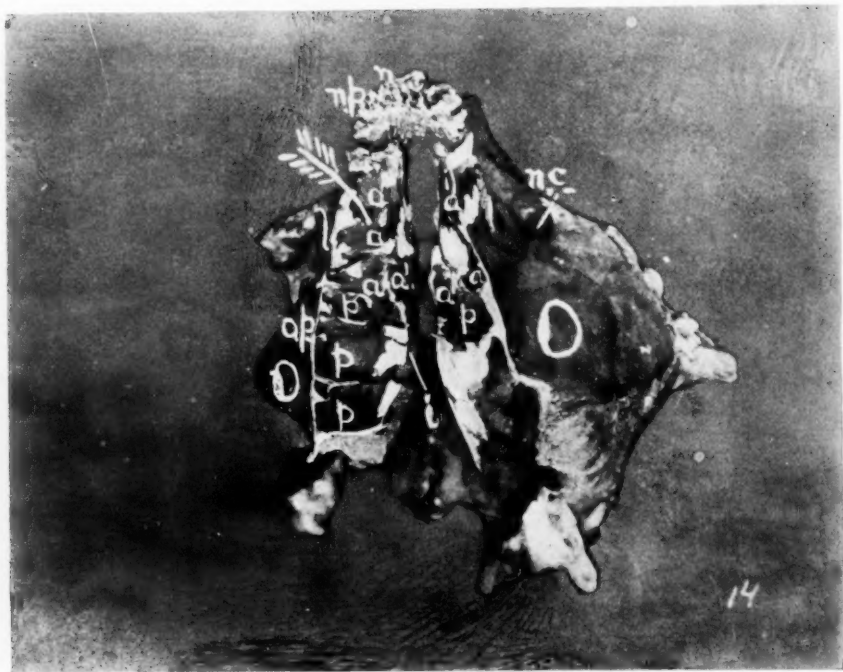


FRONTAL BONE REMOVED AT NASO-FRONTAL SUTURE, INCLUDING LAMINA CRIBROSA AND A PART OF THE LAMINA PERPENDICULARIS, VIEWED FROM BELOW, TO SHOW THE WIDTH OF THE NASAL CAVITY, AND THE AVAILABLE OPERATING SPACE. ARROW PASSING TO FRONTAL SINUS THROUGH HIATUS FRONTALIS.

*l.c.* Over the location of the lamina cribrosa. *l.p.* Lamina perpendicularis. *a.a.a.* Anterior ethmoidal cells. *p.p.p.* Posterior ethmoidal cells. *S.* Sphenoidal sinus. *O.* Roof of Orbit. *G.* Glabella. *n.* Articulates with nasal bone. *n.p.* Articulates with nasal process of superior maxilla. *l.* Articulates with lachrymal bone. *o.p.* Articulates with os planum. *i.l.* Inferior lamina of orbital portion frontal bone. *s.l.* Superior lamina of orbital portion frontal bone. *i.* Internal wall of lateral mass.



Plate 14.



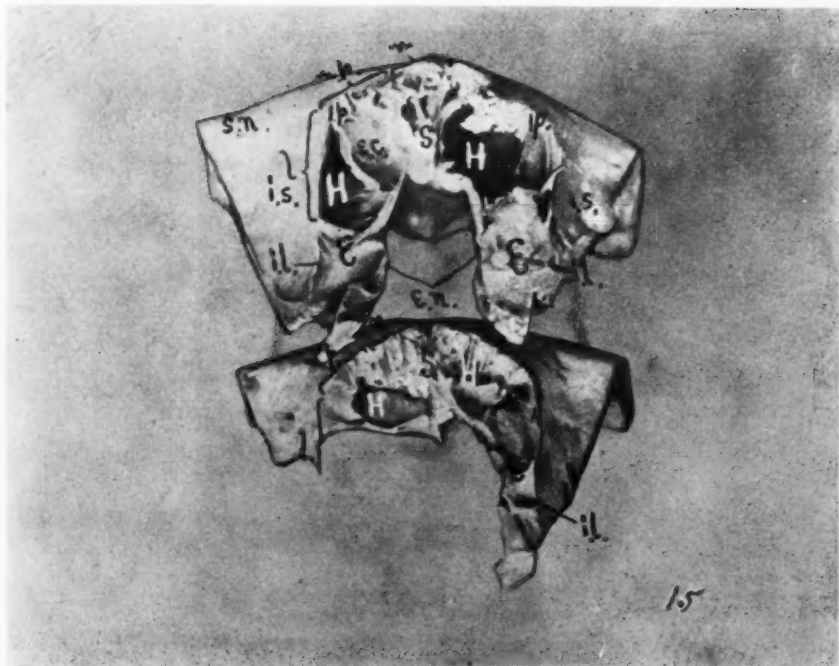
LOWER PORTION OF SPECIMEN FIGURED IN PLATE 13, SHOWING THE BROKEN CELLS OF THE LATERAL MASSES. SEPTUM OF THE NOSE MISSING.

ARROW PASSING TO INFUNDIBULUM FROM THE DIRECTION OF THE FRONTAL SINUS.

*n.* Nasal bone. *n.p.* Nasal process of superior maxilla. *l.* Lachrymal bone. *o.p.* Os Planum. *a.a.a.* Anterior ethmoid cells. *p.p.p.* Posterior ethmoid cells. *n.c.* Nasal canal. *O.* Orbital surface superior maxilla. *i.* Internal wall of lateral mass.



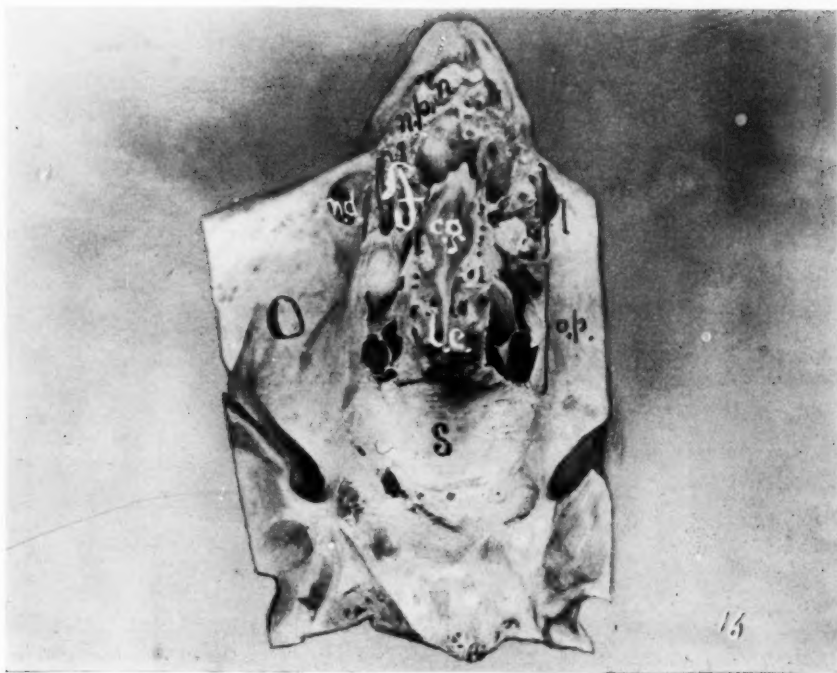
Plate 15.



INFERIOR SURFACE OF TWO FRONTAL BONES, TO SHOW THE VICINITY  
OF THE HIATUS FRONTALIS.

*H.* Hiatus Frontalis, looking into frontal sinus. *S.* Inferior border of frontal Septum. *s.n.* Supra-orbital notch. *i.p.* Internal angular process. *e.c.* Roof of an anterior ethmoid cell protruding into frontal sinus from below. *e.n.* Ethmoidal notch formed by the superior laminae of the orbital portion of the frontal bone, which articulate with the lamina cribrosa. *i.l.* Inferior lamina of same. *E.* Space between these two laminae, interrupted by septa forming broken cells, corresponding from before backwards to the anterior ethmoidal cells in the posterior angle of the frontal sinus, anterior ethmoid cells opposite Os Planum, and finally the posterior ethmoid cells. *i.s.* Orbital portion of inferior surface of frontal sinus. *n.* Articulation of nasal bone. *n.p.* Articulation of nasal process of superior maxilla. *l.* Articulation with lachrymal bone.

Plate 16.



FRONTAL BONE REMOVED, SHOWING THE BROKEN ANTERIOR AND POSTERIOR ETHMOID CELLS, AND THE THICKENED LINE OF ARTICULATION WITH THE NASAL BONES AND NASAL PROCESSES OF THE SUPERIOR MAXILLAE IN FRONT. PROBE IN LEFT OSTIUM FRONTALE.

*c.g.* Crista galli. *l.c.* Lamina cribrosa. *n.d.* Nasal duct. *n.* Nasal bone (superior border). *n.p.* Nasal process (Superior border). *l.* Lachrymal bone (Superior border). *o.p.* Os Planum (Superior border). *S.* Roof of sphenoidal sinus. *F.* Nasal portion of floor of frontal sinus. *O.* Inferior surface of orbital fossa.

(Plate 53), but it may be obscured, however, from several causes. The borders may be more than ordinarily rounded and the angles cut off by protruding cells or excess of diploe. Thus the sinus may appear as a small oval cavity. (Plates 5, 49, 50.)

*Septa.*—Wherever the sinus is of large size it is usually the rule to observe bony septa, passing most commonly between the anterior and posterior surfaces. (Plates 10, 11, 20, 55, 56.) They may be apparently complete or partial, so as to subdivide the sinus into smaller cavities. Where the septum is nearly complete the communicating foramen is usually towards the posterior border or posterior angle. The plane of the septa is most commonly rather vertically placed and running in a general antero-posterior direction, often radiating from the posterior angle. Partial septa are often of considerable thickness, and are more commonly found at the superior and anterior borders, whereas the posterior border and angle are filled with cells. Septa are easily broken down with the curette or bone forceps. They give additional strength to the walls of the sinus.

Occasionally pockets lead from the inferior portion of the sinus, thereby rendering this surface still more irregular. The nasal process (Plates 32, 37) may be thus hollowed out, and less frequently the crista galli of the ethmoid bone (Plate 26) may be only a shell containing a diverticulum from a frontal sinus. More frequently a diverticulum pushes directly downward into the space bounded externally by the lachrymal bone, internally by the upper extremity of the uncinat process of the ethmoid, and in front by nasal process of the superior maxilla. (Plates 51, 52.)

Defects in the continuity of the frontal sinus walls, described as dehiscences (Zuckerkandl), must be very unusual. None have been detected in this series of 250 sinuses. They are said to occur near the front of the fronto-nasal suture. Several instances of orbital dehiscences, however, associated with the anterior ethmoidal cells have been noted; these will be considered later.

*Ethmoid Bone.*—Such parts only of this bone will be considered as are concerned in the regional anatomy of the frontal sinus and anterior ethmoidal cells.

*Lamina Cribrosa* (Plates 13, 16, 17, 18, 72, 76).—The horizontal or cribriform plate (*lamina cribrosa*) is rectangular in shape and fills in the ethmoidal notch (Plate 15) of the frontal bone articulating on three borders with the *superior lamina* only of the orbital portion of the frontal bone. The posterior border is notched for the reception of the ethmoidal spine of the sphenoid bone. The plate is bisected by the plane of the crista galli and hollowed out for the reception of the olfactory lobes. On each side of the median line are three parallel rows of foramina for the transmission of the olfactory nerves. The foramina of the inner row are the largest, and lead to grooves on the lamina perpendicularis of the ethmoid (Plate 28); those of the median row are the smallest; and those of the outer row are intermediate in size, and lead to grooves on the inner side of the internal wall of the lateral mass. (Plates 2, 3.) Close inspection shows that the larger foramina are merely depressions, at the base of which are seen several minute openings. Anteriorly, quite close to either side of the crista galli, is a slit-like foramen for the passage of the nasal branch of the ophthalmic division of the fifth cranial nerve.

Viewed from above, the cribriform plate will be seen to be occasionally much obscured by the conformity of the orbital plate or by a wide crista galli.

*Lamina Perpendicularis* (Plates 20, 21).—Descending from the median line of the lamina cribrosa is the lamina perpendicularis which completes the greater portion of the upper part of the nasal septum. It is a somewhat quadrangular section of bone, thinner in the centre than at the periphery. The superior border is attached to the cribriform plate, and terminates at the anterior extremity of this plate.

The anterior border, two centimetres to three centimetres long, runs downward and forward, articulating above with the nasal process of the frontal bone and near its ex-

tremity with the crest of the nasal bones. (Plates 19, 26.) The plane of the lamina perpendicularis is usually concave to one side or the other, and its surface grooved vertically for nasal nerves.

*Crista Galli.*—In the same median plane, but situated above and on the anterior portion of the lamina cribrosa, is a prominent triangular crest of bone called the crista galli. On each side of its anterior border is a process (processus alaris) which helps complete the foramen cæcum when articulated with the frontal bone. The crista galli lies behind and occasionally above the septum, between the frontal sinuses, and generally in close proximity. (See sagittal sections.) It may be thin and dense, or wide and cancellated; its anterior border may be free or closely associated with the posterior surface of the frontal sinus, and in exceptional cases it may be hollow and form a portion of the sinus itself,—crista galli diverticulum. (Plates 10, 26.)

*Lateral Masses. Ethmoidal Labyrinth* (Plates 17, 18, 19, 20, 21).—The lateral masses of the ethmoid bone are two irregular bony structures, one suspended on either side of the lamina perpendicularis from the lamina cribrosa. Each lateral mass presents an inner and an outer wall, between which is an intricate cellular net-work, called the ethmoidal labyrinth.

The outer wall consists of a thin, rectangular lamina of bone, called the os planum (lamina papyracea), which forms a portion of the inner wall of the orbital fossa. (Plate 9.) When the ethmoid bone is disarticulated, the os planum is surrounded on all sides by a series of seemingly broken cellular spaces (Plate 19), but in the natural state these cells are completed by neighboring bones. The superior border of the os planum articulates with the *inferior* lamella of the orbital portion of the frontal bone, so that, obviously, the broken cellular spaces between this border and the cribriform plate are completed by corresponding spaces between the orbital laminae. Hence, superiorly the ethmoid cells are partially within the frontal bone. (Plates 13, 14.) The eth-

moidal foramina are at either extremity of this suture, the anterior of which will concern us later.

The anterior border of the os planum articulates with the lachrymal bone, which also covers in the cellular spaces here. (Plates 5, 69.)

The inferior border articulates with the orbital surface of the superior maxilla, and the posterior border does not concern us.

The os planum is usually intact, but dehiscences occur (Plates 48, 50), the importance of which will be considered with the anterior ethmoidal cells.

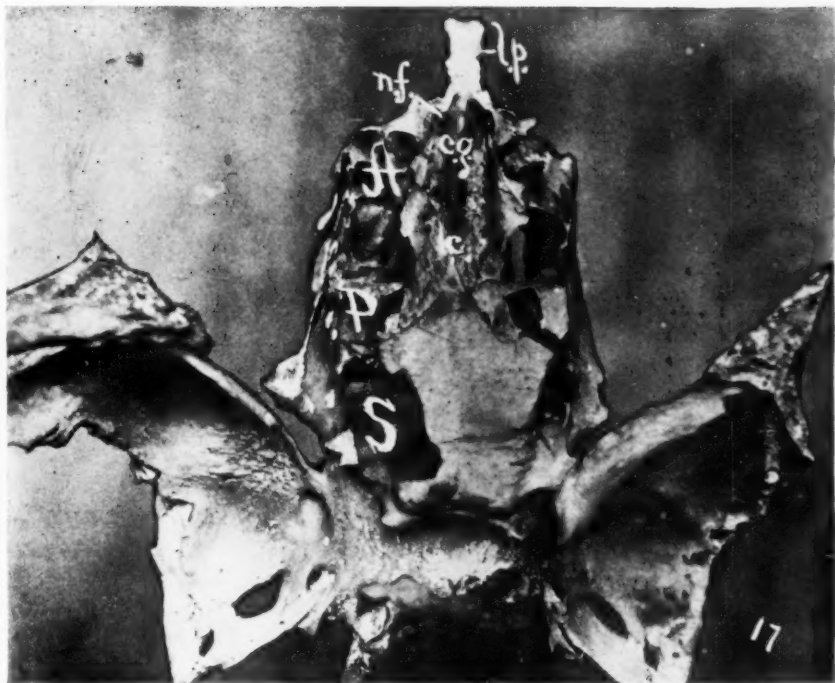
Before passing within the nasal cavity for the consideration of the inner wall of the lateral mass and the anterior ethmoidal cells, let us complete the internal orbital wall, as far as may concern us.

*Lachrymal Bone* (Ossa Unguis) (Plates 5, 9, 27).—Directly anterior to the os planum is the lachrymal bone with its two surfaces and four borders. The bone is thin and scale-like, with no cellular spaces.

The outer or orbital surface is divided unequally by a vertical ridge called the lachrymal crest, giving origin in part to the tensor tarsi muscle. The surface posterior to this crest is smooth and is in direct continuity with the surface of the os planum, the inferior lamina of the orbital portion of the frontal bone, and the orbital surface of the superior maxilla. The surface anterior to the crest is narrower but longer than the posterior, is concave throughout its vertical extent, and prolonged inferiorly in order to complete the inner and posterior bony canal for the nasal duct. The superior portion of this surface lodges the lachrymal sac.

The inner or nasal surface of the lachrymal bone is characterized by a groove corresponding to the lachrymal crest. Running obliquely across the surface from before backward and downward is the inferior border of the uncinatè process of the ethmoid bone. This border is in contact directly, or by means of small processes, and in the natural state the soft parts complete this continuity. (Plates 8, 10, 11, 12.) The

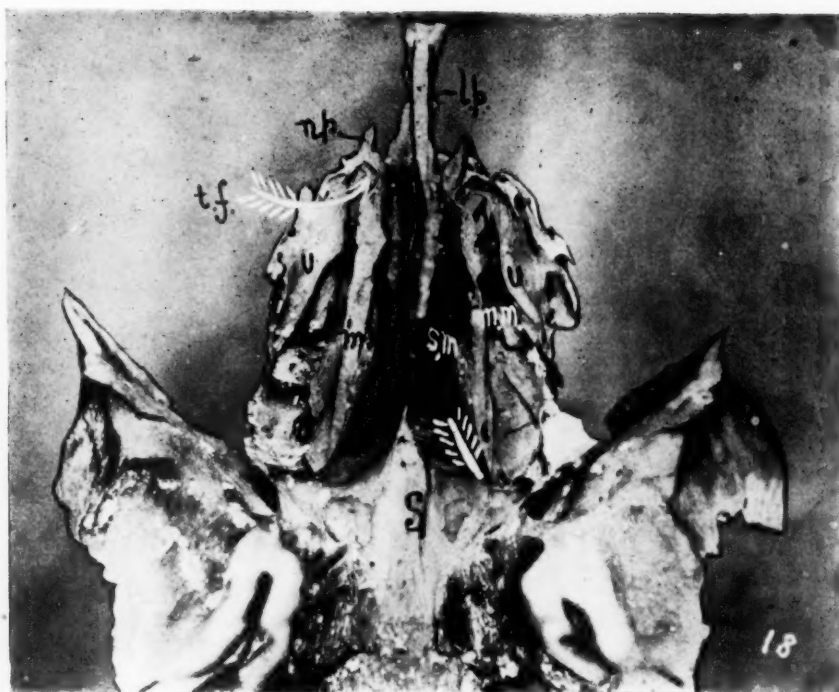
Plate 17.



SUPERIOR SURFACE OF ETHMOID AND SPHENOID BONES, SHOWING THE BROKEN ANTERIOR AND POSTERIOR ETHMOID CELLS, AND OPENING INTO LEFT SPHENOIDAL SINUS.

*A.* Anterior ethmoid cells. *P.* Posterior ethmoid cells. *S.* Sphenoidal sinus. *lc.* Lamina cribrosa. *c.g.* Crista Galli. *nf.* Naso-frontal canal. *lp.* Lamina perpendicularis.

Plate 18.

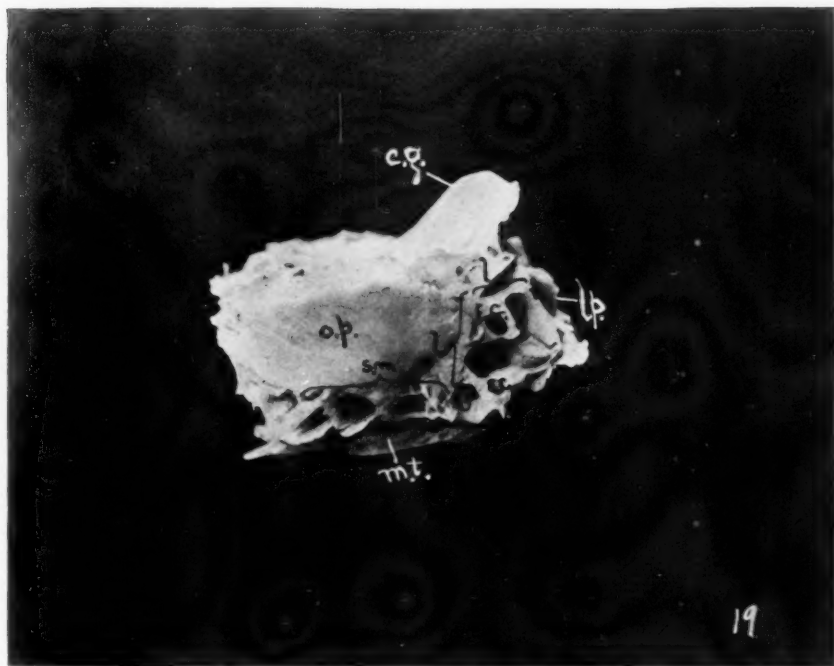


INFERIOR SURFACE OF SAME BONES. ARROW IN LEFT OSTIUM SPHENOIDALE.

*S.* Inferior surface of body of sphenoid bone. *m.t.* Inferior border of middle turbinate. *U.* Uncinate process. *n.p.* At point of union of middle turbinate and uncinatc process, which articulates with the nasal process of the superior maxilla. *l.p.* Lamina perpendicularis. *s.m.* Superior meatus. *m.m.* Middle meatus. *t.f.* Arrow directed toward turbinate fossa.



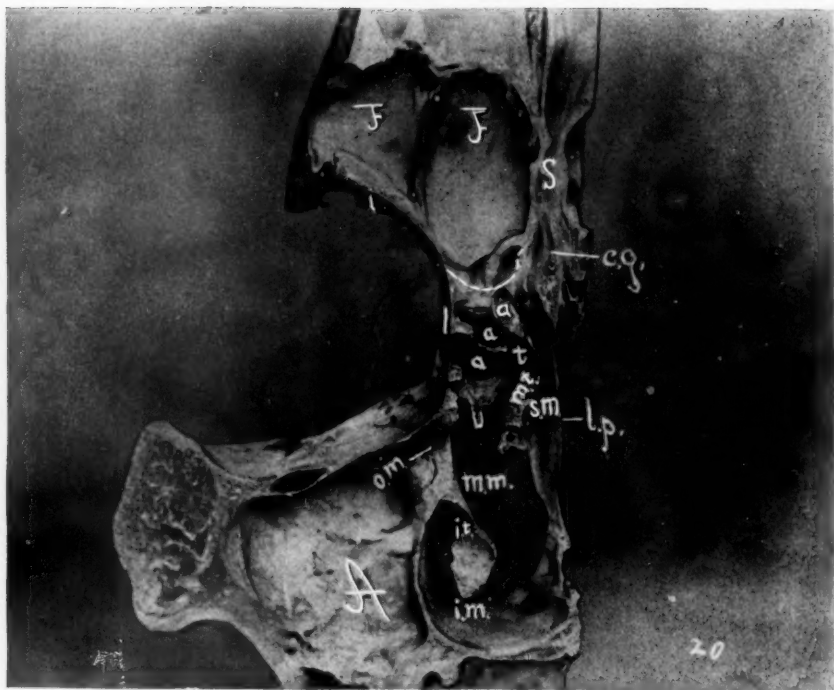
Plate 19.



LATERAL VIEW OF A DISARTICULATED ETHMOID BONE.

*o.p.* Os Planum. *U.* Uncinate process. *m.t.* Middle turbinate. *p.* Lamina perpendicularis. *c.g.* Crista Galli. *e.c.* Broken anterior ethmoidal cells completed by articulation with lachrymal bone. *i.* Dilated cell like termination of Infundibulum bounded internally by the uncinate process (upper extremity), and externally by the lachrymal bone. *s.m.* Lower border of Os Planum, articulating with orbital surface of superior maxilla. *l.* Articulation of lachrymal bone.

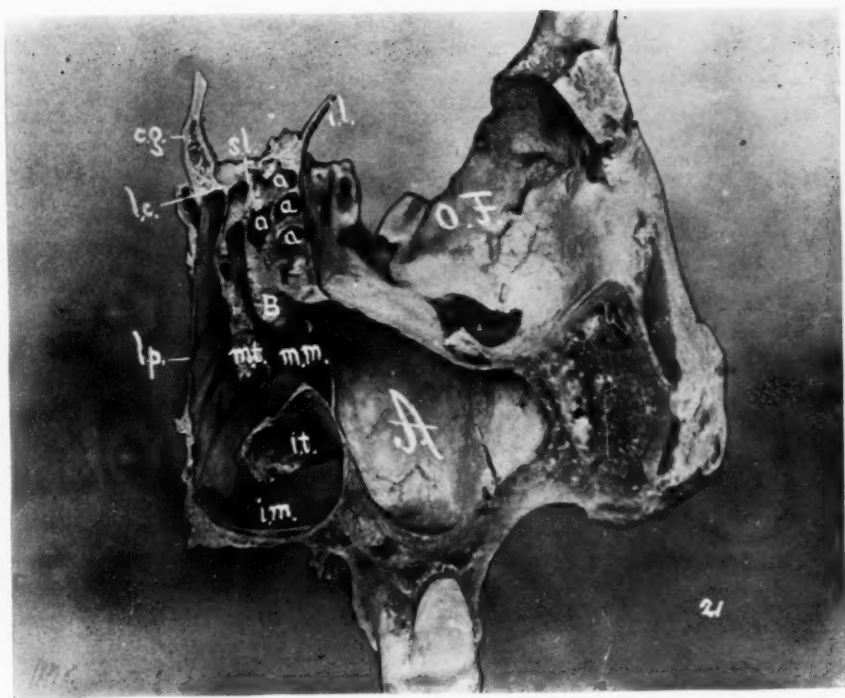
Plate 20.



BONE. CORONAL SECTION THROUGH OSTIUM MAXILLARE. ANTERIOR HALF.  
POSTERIOR WALL OF FRONTAL SINUS REMOVED.

*F.* An anterior wall of frontal sinus, showing a vertical Septum. *S.* Septum between the frontal sinuses. *i.t.* Inferior turbinate. *m.t.* Middle turbinate. *o.m.* Ostium Maxillare. *U.* Uncinate Process. *l.* Os lachrymale. *t.* Turbinate fossa. *a.a.a.* Anterior ethmoidal cells, internal to lachrymal bone. *A.* Antrum of Highmore. *l.p.* Lamina perpendicularis. *c.g.* Crista Galli. *i.m.* Inferior meatus. *m.m.* Middle meatus. *s.m.* Superior meatus. *i.* Inferior wall of frontal sinus (Orbital portion). Dotted line corresponds to nasal portion. See Plate 21.

Plate 21.



POSTERIOR HALF OF SAME SECTION.

*A.* Antrum. *mt.* Middle turbinate. *it.* Inferior turbinate. *B.* Bulla ethmoidalis. *im.* Inferior meatus. *mm.* Middle Meatus. *aaa.* Anterior ethmoid cells just above Bulla and internal to lachrymal bone and Os Planum. *il.* Portion of inferior lamina of horizontal part of frontal bone. *sl.* Point of articulation of superior lamina of same, with lamina cribrosa. *O.F.* Orbital fossa. *lp.* Lamina perpendicularis. *cg.* Crista Galli. *lc.* Lamina cribrosa forming roof of nasal fossa.

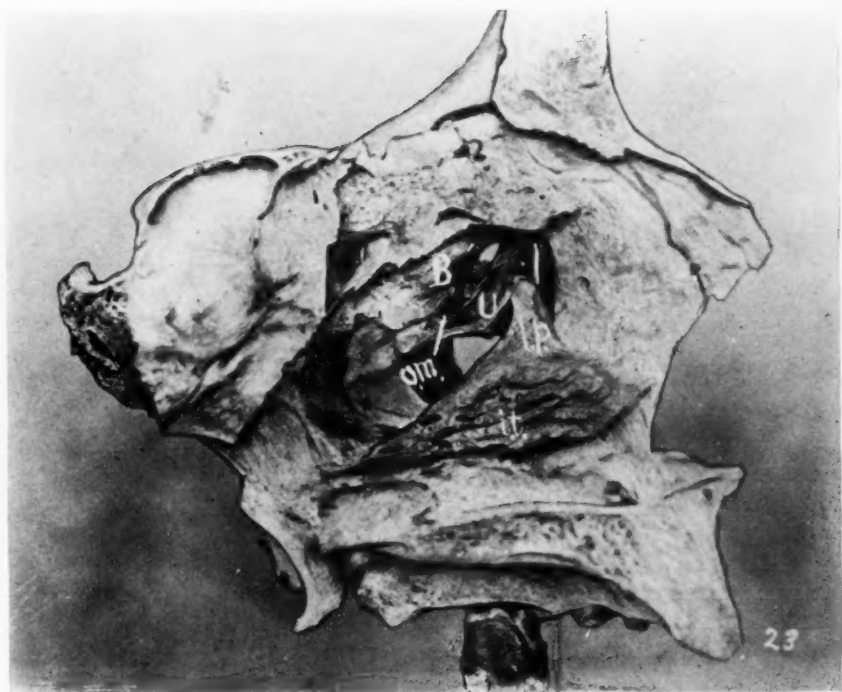
Plate 22.



BONE. RIGHT NASAL FOSSA, EXTERNAL SURFACE, MIDDLE TURBINATE  
REMOVED ALONG DOTTED LINE.

*B.* Bulla ethmoidalis. *U.* Uncinate process, making a complete bony Ostium maxillare, and its anterior border articulating directly with the lachrymal bone, and inferior turbinate bone. *l.* lachrymal bone. *i.t.* Inferior turbinate. *l.p.* Its lachrymal process. *o.m.* Ostium maxillare. *i.m.* Inferior meatus. *a.a.a.* Anterior ethmoid cells above Bulla. *o.* Ostium of Bulla. *i.i.i.* Infundibulum. *F.* Anterior wall of frontal sinus. *z.* nasal process of frontal bone. *n.* Nasal bone.

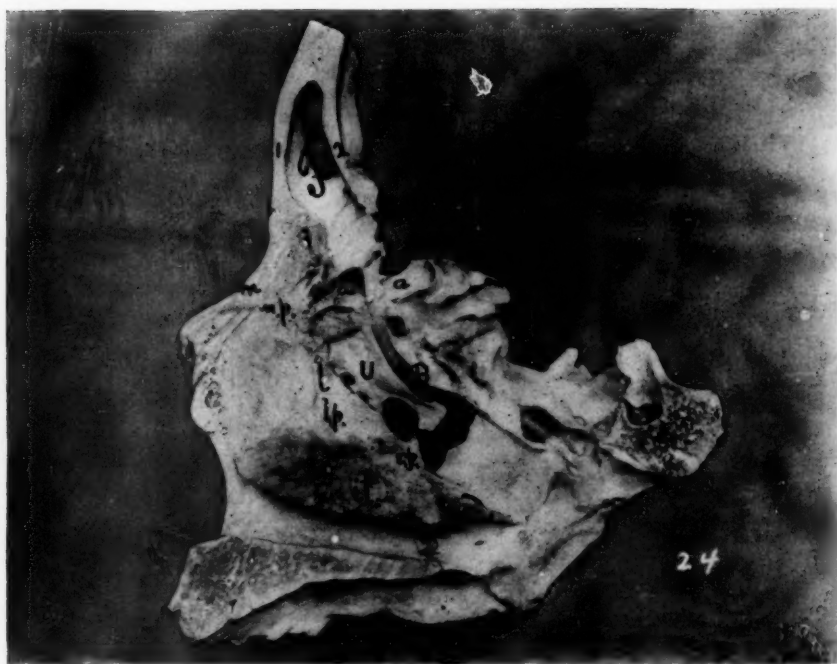
Plate 23.



LEFT NASAL FOSSA, EXTERNAL WALL, SHOWING PROBE IN COMPLETE BONY OSTIUM MAXILLARE, MIDDLE TURBINATE REMOVED.

*U.* Processus Uncinatus. *B.* Bulla ethmoidalis. *i.t.* Inferior turbinate. *l.p.* Its lachrymal process. *l.* Os lachrymale. *o.m.* Ostium Maxillare.

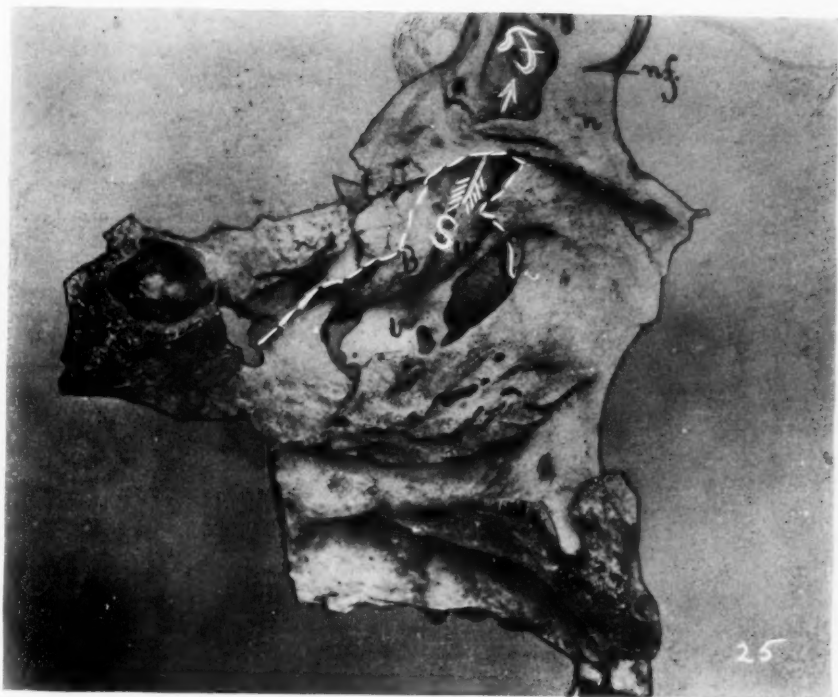
Plate 24.



RIGHT NASAL FOSSA, EXTERNAL WALL.

*F.* Frontal sinus. *1.* Its flattened anterior surface. *2.* Posterior surface.  
*3.* Thick ridge formed at naso-frontal articulation, anterior to Hiatus frontalis.  
*U.* Uncinate process. *B.* Bulla ethmoidalis. *l.* Lachrymal bone. *i.t.* Inferior  
 turbinate. *l.p.* Its lachrymal process. *e.p.* Its ethmoid process. *n.* Nasal bone.  
*n.p.* Nasal process of superior maxilla. *a.a.a.* Anterior ethmoid cells.

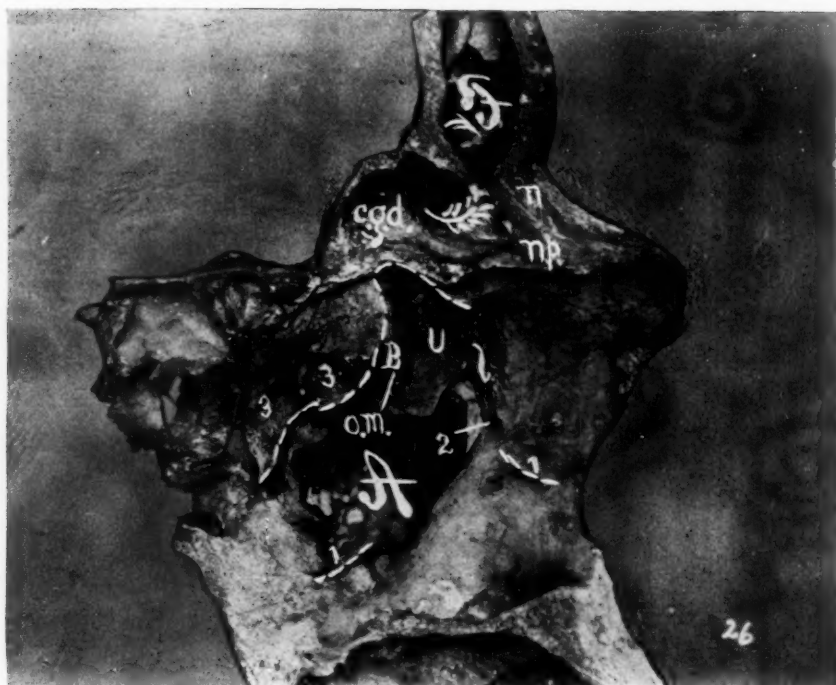
Plate 25.



BONE. LEFT NASAL FOSSA, EXTERNAL WALL. BULLA AND UNCINATE PROCESS  
 VERY CLOSELY APPROXIMATED, AND SO MUCH SO IN THE RECENT STATE,  
 THAT THE HIATUS SEMI-LUNARIS WAS REDUCED TO A SMALL OS-  
 TUM AND THE INFUNDIBULUM CONVERTED INTO A CANAL  
 FOR NEARLY ITS WHOLE EXTENT. DOTTED LINE  
 MARKS REMOVAL OF MIDDLE TURBINATE.  
 FRONTAL SINUS VERY LARGE WITH  
 PROTRUDING SUPERCILIARY  
 RIDGE.

*F.* Frontal sinus. *n.* Nasal bone. *n.f.* Naso-frontal suture. *B.* Bulla eth-  
 moidalis. *U.* Uncinate process. Arrow passes from turbinate fossa through  
 Ostium frontale to frontal sinus. *I.* Lachrymal bone. *S.* Broad Septum between  
 Uncinate and Bulla.

Plate 26.



BONE. LEFT NASAL CAVITY, EXTERNAL WALL. ANTRUM EXPOSED, LOWER PORTION OF UNCINATE PROCESS BROKEN OFF. INFERIOR TURBinate BONE REMOVED. MIDDLE TURBinate BONE REMOVED ALONG DOTTED LINE.

*F.* Frontal sinus. *c.g.d.* Large Crista Galli diverticulum. Arrow passing between two chambers of the frontal sinus. *B.* Small Bulla ethmoidalis. *U.* Uncinate process. *o.m.* Ostium maxillare. *n.* Nasal bone. *n.p.* Nasal process of frontal bone. *1.* Inferior turbinate crests of superior maxillary and palate bones, for articulation with inferior turbinate bone. *2.* Opening of nasal duct completed by turbinate bone. *3.* Fissura Ethmoidalis Inferior. *A.* Antrum. *l.* Lacrymal bone.



upper surface of the nasal aspect of the lachrymal, as thus marked off by the uncinatè process, goes to complete, externally, certain of the anterior ethmoidal cells, oftentimes the cellular space corresponding to the *agger nasi* (see inferior ethmoidal turbinate), and a portion of the upper and outer wall of the infundibulum. (Plates 5, 7, 9, 10.) This surface is marked irregularly by slightly elevated ridges corresponding to cellular laminæ of the ethmoid. (Plate 27.)

The somewhat triangular and smaller inferior portion of this nasal aspect forms a portion of the outer wall of the nasal fossa, situated on the same plane and articulating with the posterior border of the nasal process of the superior maxilla, and continues posteriorly with the upper portion of the uncinatè process either directly by bone or in the recent state by mucous membrane. Directly external and anterior to this portion of the nasal surface is the nasal duct.

Inferiorly this surface is continued as a process to articulate with the lachrymal process of the inferior turbinate bone so as to complete internally the bony nasal canal. (Plates 22, 24.) Just before the lachrymal crest reaches the inferior border, it is continued as the hamular process, outward and forward along the edge of the orbital surface of the superior maxilla to the lachrymal tubercle of the same bone, so as to complete the bony ring of entrance to the nasal canal. This process may be a separate piece of bone.

The superior border is short, thickened at its anterior extremity, and articulates with the internal angular process of the frontal bone. It is in direct continuity with the external margin of the hiatus frontalis. (Plate 20.) The anterior border is the longest, articulates with the posterior border of the nasal process of the superior maxilla, and terminates inferiorly with the prolongation which meets the lachrymal process of the inferior turbinate bone. The posterior surface articulates with the *os planum* provided the lachrymal bone is complete, otherwise it is a free ragged edge. It is not unusual to find the posterior portion of the lachrymal bone deficient (lachrymal dehiscence), in which

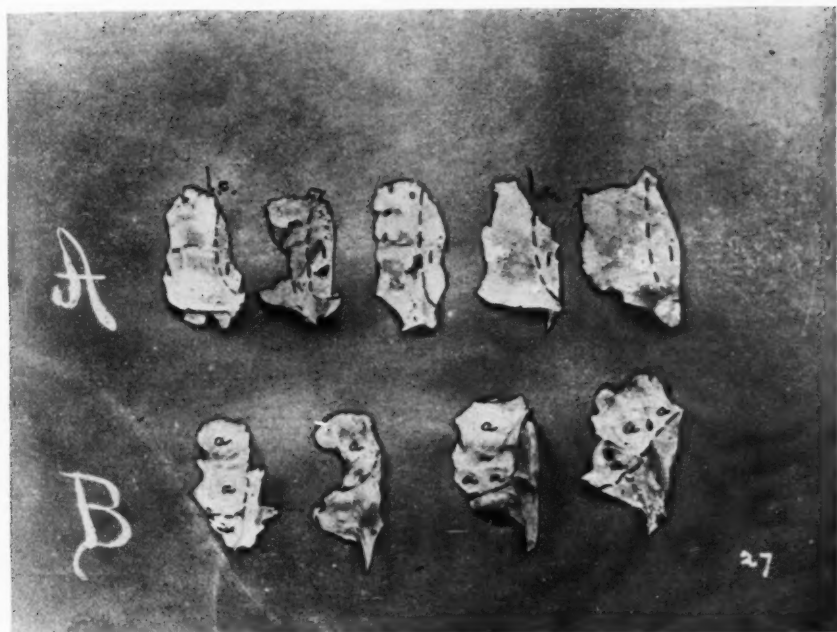
case the continuity is restored by fibrous membrane. The inferior border, divided unequally by the lachrymal crest, articulates posteriorly with the orbital surface of the superior maxilla, anteriorly with the inferior turbinate as a rule.

In some instances where the lachrymal bone is small or deficient, compensatory laminae from any neighboring bones may complete this internal bony wall of the orbital fossa. The relations about this bone are of much importance in the surgery of the anterior ethmoidal cells and frontal sinus.

Continuing the internal orbital wall forward (Plates 5, 9), it is seen to be completed by the nasal process of the superior maxilla. This process is a dense, rather vertically placed lamina of bone, projecting from the upper and front portion of the superior maxilla. Its external surface is smooth, slightly concave, gives origin to certain facial muscles, and is perforated by nutrient foramina. It continues anteriorly with the external surface of the nasal bone. Its internal surface (Plates 10, 11) forms part of the outer wall of the nasal fossa. A small upper portion is roughened and continues around to the thickened posterior border, articulates with the anterior extremity of the lateral mass of the ethmoid, thereby completing certain anterior ethmoidal cells. (Plates 20, 24.) Just below this small area is the superior turbinate crest for the anterior extremity of the inferior turbinate of the ethmoid (so-called "middle turbinate bone"), and also, in most cases, the anterior extremity of the inferior border of the uncinat process. (Plates 10, 11.) At the lower border of this nasal surface of the process under consideration is a second horizontal crest, for articulation with the inferior turbinate bone. Between these crests the surface is slightly concave and quadrangular, not so smooth as the outer surface, covered in the recent state by mucous membrane, and forms a very firm boundary of the outer nasal wall. To a more or less degree this surface is overlapped by the inferior turbinated bone of the ethmoid.

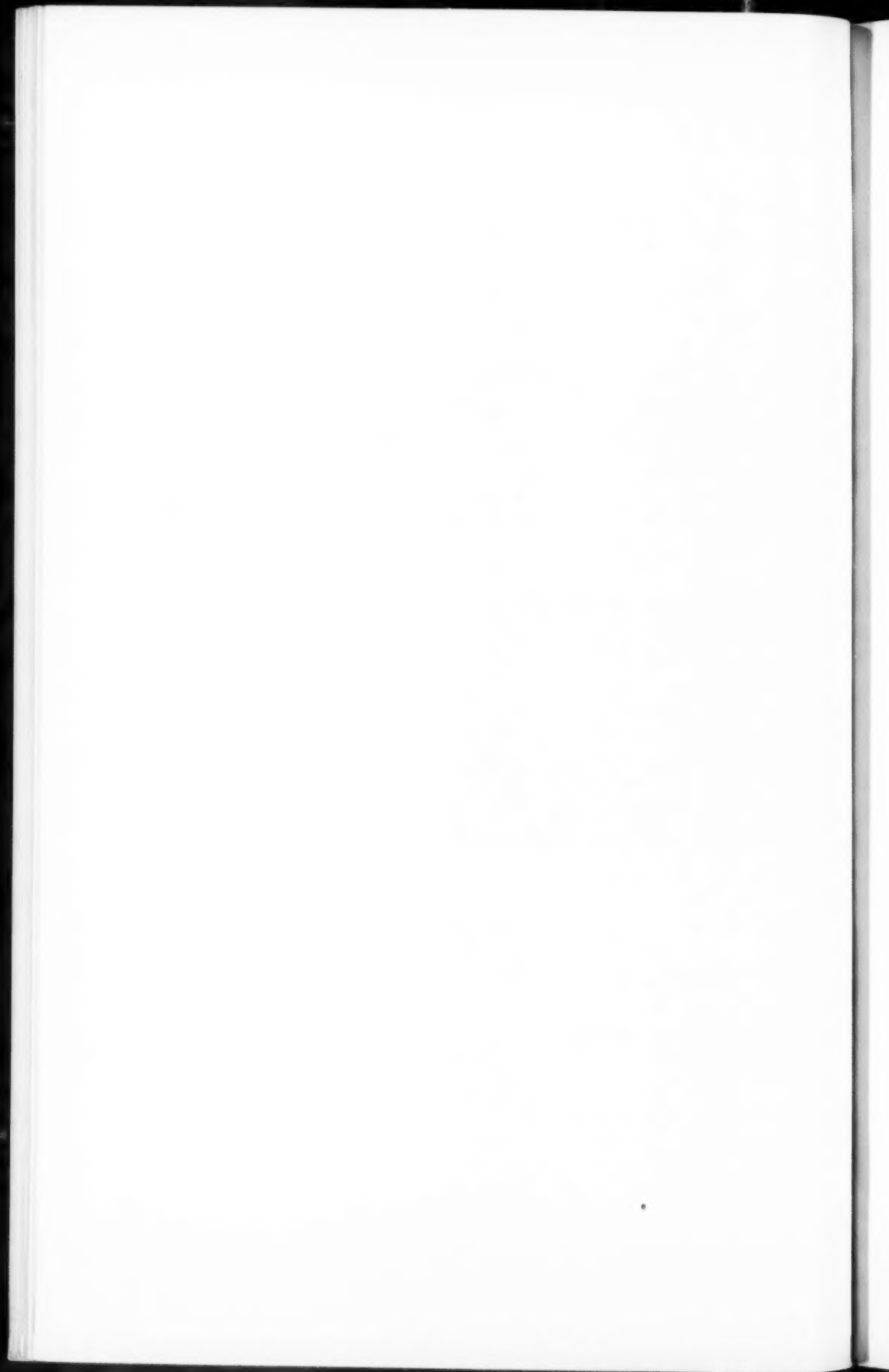
The superior border of the nasal process is very short and thick, and deeply and finely denticulated for articulation

Plate 27.



A SERIES OF LACHRYMAL BONES.

*A.* Right lachrymal bones, orbital surface. *B.* Left lachrymal bones, nasal surface. *l.c.* Lachrymal crest. *l.* Lachrymal groove. *a.a.a.* Depressions separated by slightly elevated ridges, completing certain anterior ethmoid cells. Dotted line corresponds to inferior border of uncinat process, the portion of bone below which completes a part of the external wall of nasal fossa. The surface of bone above this line completes ethmoidal cells.



with the frontal bone. This suture is at the anterior edge of the hiatus frontalis, extending laterally to be continued by the superior border of the lachrymal bone. In front, towards the median line, this suture is completed by the nasal bone (Plate 1), the upper border of which is equally thick as compared with that of the nasal process of the superior maxilla. Between the two internal angular processes of the frontal bone is the frontal notch, for the reception of the nasal processes and nasal bones. This region is just anterior to the margin of the hiatus frontalis of either side (Plate 15), and to the bony space between these openings into the frontal sinus, which is the lower, often much thickened, border of the interfrontal septum. (Plate 56.) According to the deviation of this septum, the size of the hiatus frontalis, the relative width of the nasal bone and nasal process, a part of the superior border of the nasal bone must be considered as bounding this hiatus. This partial bony ring bounding the anterior and lateral aspects of the hiatus is of much surgical importance in operations for curetting the cells about the ostium frontale and the complete removal of the nasal portion of the floor of the frontal sinus. (Plates 15, 16.) (The terms "hiatus frontalis" and "ostium frontale" must not be confused. The former refers to the opening in the frontal bone itself, and practically indicates the extent of the nasal portion of the floor of the frontal sinus after the ethmoid bone has been removed. The ostium frontale refers to the foramen of communication between the frontal sinus and nasal cavity when all the bones are *in situ*.)

To return to the nasal process of the superior maxilla. The posterior border, very thick, is marked by a groove which crosses diagonally from above downward and inward, and lodges the lachrymal sac and nasal duct. The inner border of the groove articulates with the lachrymal bone, the outer border is the anterior boundary of the inner wall of the orbital fossa. The anterior border is comparatively thin, and articulates with the nasal bones. (Plates 5, 9.)

*Nasal Bones.*—The general curves of the external sur-

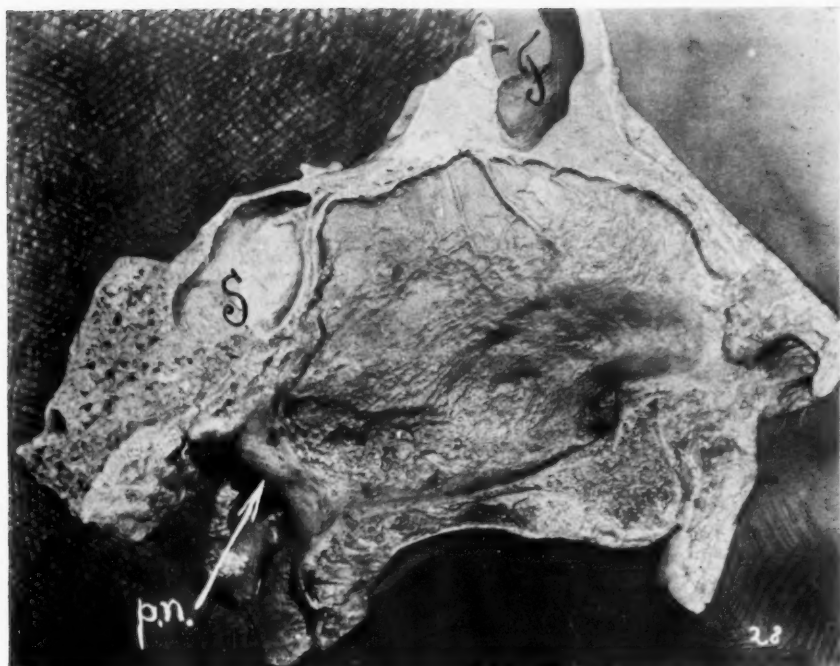
face of the nasal process of the superior maxilla and of the anterior wall of the frontal sinus are continued on to the outer surface of the nasal bone, interrupted only by the sutures already mentioned. (Plate 9.) The thickness of the superior border has been noted. The inner surface, for the most part, belongs to the lateral wall of the nasal fossa (Plate 11), but a small median strip forms the anterior limit of the roof of the nasal fossa, and is directly continuous posteriorly with a portion of the roof formed by the thick inferior border of the frontal septum (Plate 56), which in turn passes on to the lamina cribrosa. At the internasal suture the inner surface of the bones is raised to form the nasal crest, which is the beginning of the inner wall of the nasal fossa. This crest articulates for the whole or part of its extent with the nasal process of the frontal bone (Plate 11), otherwise with a portion of the lamina perpendicularis of the ethmoid, and on either side is a groove for the nasal nerve in its course from the nasal slit in the lamina cribrosa. Continuing the median line posterior and inferior to the median septum and nasal spine of the frontal bone, we come to the lamina perpendicularis, which forms a large part of the inner wall of the nasal fossa. (Plates 2, 77.)

It is of practical importance to note at this point, although a matter of repetition, that anteriorly and internally the hiatus frontalis is surrounded by an incomplete ring of often very dense bone, which may narrow its lumen or extend across the anterior portions of the nasal floor of the sinus, thus obstructing the passage of instruments from below, and serving as a troublesome barrier in external operations aimed to enlarge the opening between the frontal sinus and nasal cavity.

Let us now consider the inner wall of the lateral mass. (Plates 2, 3, 4, 21, 29, 30, 69, 70, 78.)

This lamina of rough bone, thicker than the outer wall of the labyrinth (*os planum*), passes vertically downward from the lamina cribrosa for a variable distance, serving both as the inner boundary of the labyrinth and as the superior

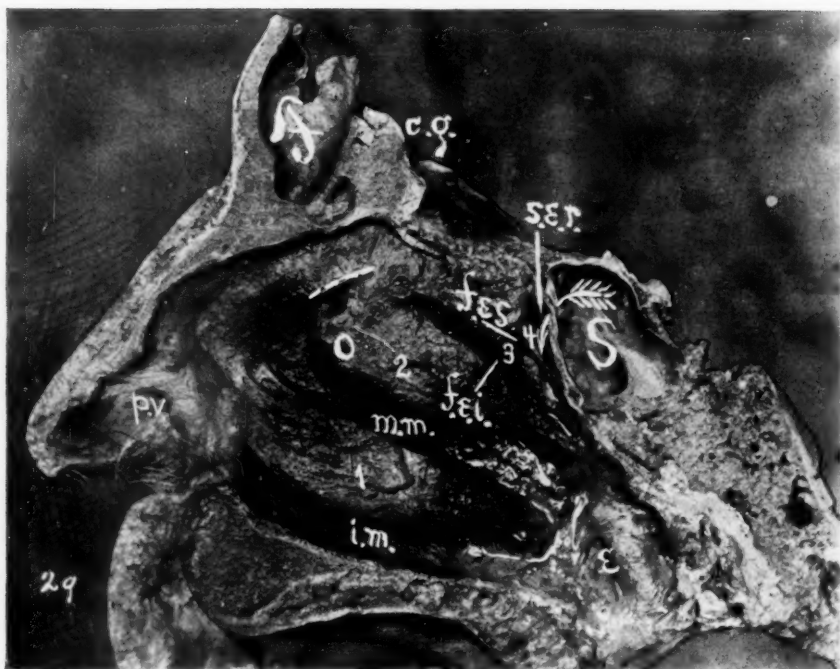
Plate 28.



SAGITTAL SECTION, SHOWING SEPTUM NASI.

*F.* Frontal sinus. *S.* Sphenoidal sinus. *p.n.* Posterior nares.

Plate 29.

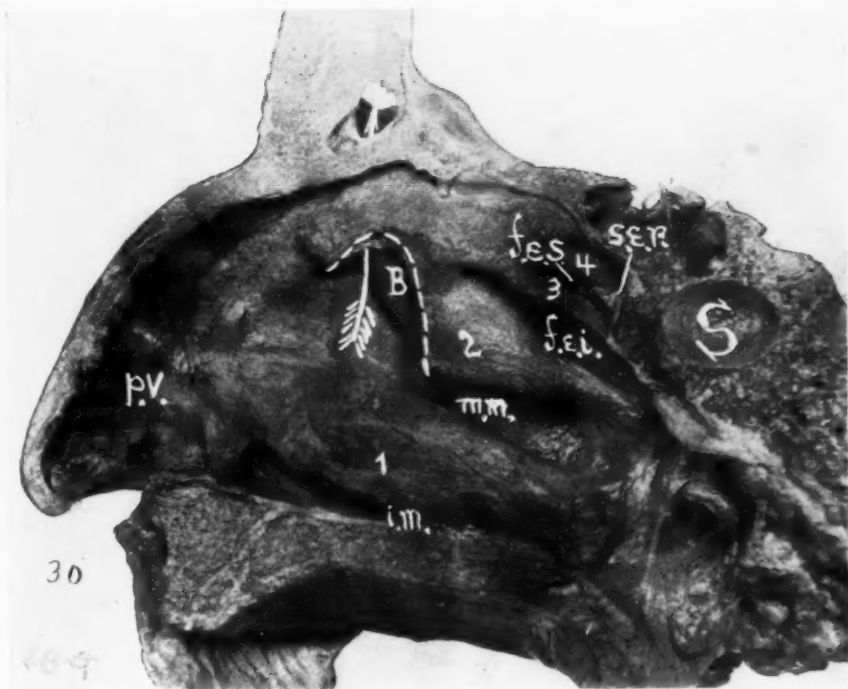


SAGITTAL SECTION, EXTERNAL WALL OF RIGHT NASAL FOSSA.

*F.* Frontal sinus. *S.* Sphenoidal sinus. *1.* Inferior turbinate bone. *2.* Inferior ethmoidal turbinate bone ("middle turbinate.") *3* and *4.* Middle and superior ethmoidal turbinate bones. *i.m.* Inferior meatus. *m.m.* Middle meatus. *f.e.i.* Fissura ethmoidalis inferior. *f.e.s.* Fissura ethmoidalis superior. *s.e.r.* Spheno-ethmoidal recess. Arrow passes through Ostium sphenoidale. *p.v.* Plica vestibuli. *c.g.* Crista Galli. *e.* Orifice of Eustachian canal. *o.* Operculum. Dotted line corresponds to an incision in middle turbinate bone necessary before removal of its anterior portion, in order to expose satisfactorily the upper extremity of Infundibulum.



Plate 30.



RIGHT NASAL FOSSA, EXTERNAL WALL, PORTION OF MIDDLE TURBINATE  
REMOVED, AS SHOWN BY DOTTED LINE.

*B.* Ethmoid Bulla. Arrow passes through Hiatus semi-lunaris into Infundibulum via naso-frontal duct to frontal sinus. *1.* Inferior turbinate bone. *2.* Middle Turbinate bone. *3 and 4.* Superior and middle ethmoidal turbinate bones. *p.v.* Plica vestibuli. *i.m.* Inferior meatus. *m.m.* Middle meatus. *f.e.i.* Fissura ethmoidalis inferior. *f.e.s.* Fissura ethmoidalis superior. *s.e.r.* Spheno-ethmoidal recess. *S.* Sphenoidal sinus.

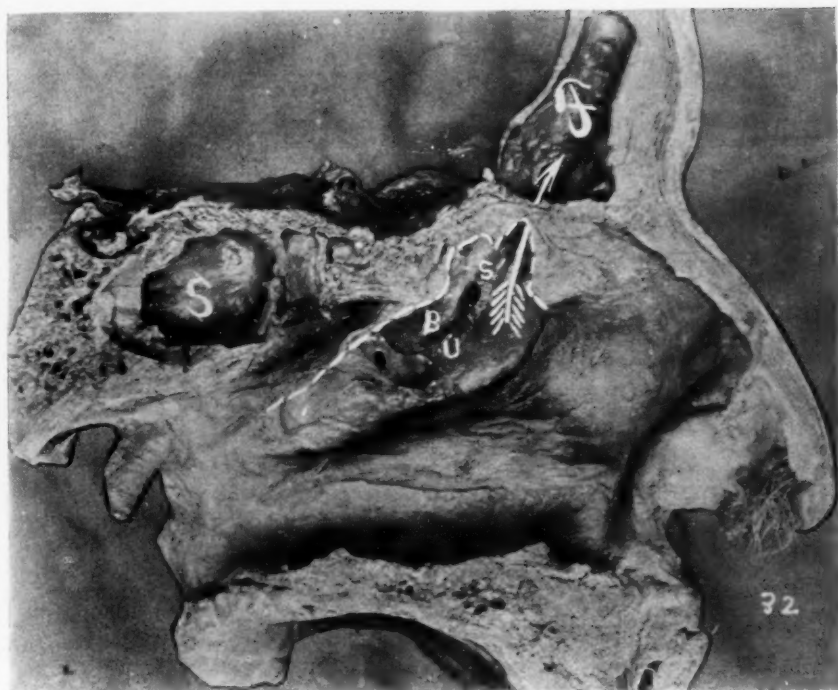
Plate 31.



RIGHT NASAL CAVITY EXTERNAL WALL, MIDDLE TURBinate BONE REMOVED  
ALONG DOTTED LINE.

*B.* Bulla ethmoidalis, its Ostium just above. *U.* Uncinate process. *S.* Septum between Uncinate and Bulla. Arrow passes through turbinate fossa and Ostium frontale into frontal sinus. *h.s.* Hiatus Semi-lunaris leading to infundibulum.

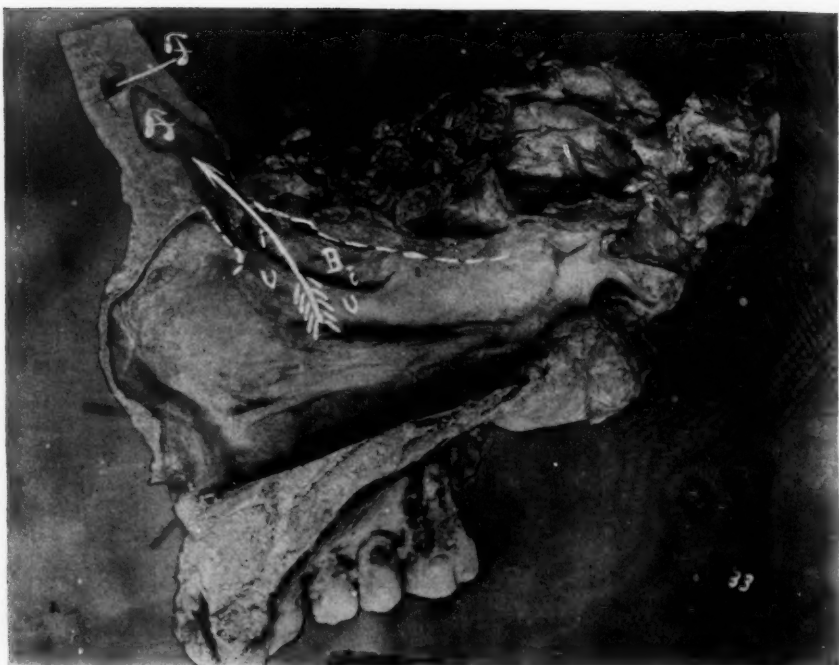
Plate 32.



LEFT NASAL CAVITY, EXTERNAL WALL, MIDDLE TURBinate BONE REMOVED  
ALONG DOTTED LINE. ARROW PASSES FROM TURBinate FOSSA  
TO FRONTAL SINUS.

*B.* Bulla ethmoidalis in contact with Uncinate process below. *U.* Uncinate process, Hiatus semi-lunaris between. *s.* Septum between Uncinate and Bulla, separating turbinate fossa from upper end of Infundibulum. *F.* Frontal sinus. *S.* Sphenoidal sinus.

Plate 33.



RIGHT NASAL FOSSA, EXTERNAL WALL, MIDDLE TURBinate BONE REMOVED,  
SHOWING INFUNDIBULUM CARRIED NEARLY TO FLOOR OF FRONTAL  
SINUS, AND CONTINUED AS A SHORT NASO-FRONTAL  
CANAL, AS SHOWN BY COURSE OF ARROW.

*F.* Frontal sinus divided by a septum. *U.* Uncinate process. *B.* Small Bulla with a long ostium above it. *i.i.* Marks outer wall of infundibulum with a long ostium above it.

portion of the external wall of the nasal fossa. It terminates below in a free curled lamina of bone called the inferior turbinate body of the ethmoid bone, but more commonly spoken of as the middle turbinate bone.

The superior border of this wall arises from the whole length of the under surface of lamina cribrosa, just external to the outer line of foramina cribrosa (Plate 13), so that its inner surface is grooved by the olfactory nerves, which reach it immediately on emerging from the foramina. This border is nearly parallel with the lamina perpendicularis, but is slightly convex towards the median line, hence the narrowest part of the roof of the nasal fossa is near the centre of the lamina cribrosa, and becomes wider in front between the nasal processes of the superior maxilla, and behind near the anterior surface of the body of the sphenoid bone. This narrow portion of the roof will average one millimetre to five millimetres wide. The wider it is, just so much more room is gained by the surgeon.

Running parallel and external to the superior border of this boundary of the lateral mass is a narrow strip of the lamina cribrosa from two millimetres to five millimetres wide. This has a free, external, ragged border in the disarticulated bone, but in the natural state it articulates with the superior lamella of the orbital plate of the frontal bone and enters into the formation of a part of the roof of both the anterior and posterior ethmoidal cells. This is the outer rim of the lamina cribrosa, is devoid of foramina, and is frequently hidden by the orbital plate if the latter is markedly prominent towards the median line. (Plates 16, 17, 76.)

Posteriorly this superior border passes from the cribriform plate to the under surface of the ethmoidal spine of the sphenoid bone, and, curving outward, it descends on the anterior surface of the body of the sphenoid. The anterior border of the inner wall of the labyrinth becomes the anterior border of the inferior ethmoidal turbinate, and will be described below. The inferior border hangs as a thickened free edge of this same turbinate. (Plates 2, 20, 58.) The inner

surface is rough and marked superiorly by vertical grooves for the olfactory nerves.

The most striking landmark on this surface is a deep fissure, the inferior fissura ethmoidalis, which marks off the posterior half of the inferior ethmoidal turbinate. (Plates 2, 3, 8, 29.) It arises somewhat below the centre of this surface about fifteen millimetres to twenty millimetres from the anterior border, and runs obliquely downward and backward towards the speno-palatine foramen. Below it bounds the upper border of a portion of the lower ethmoidal turbinate, and above it is the lower edge of the succeeding ethmoidal turbinate. There may be one, two, or three of these fissuræ ethmoidales, with a corresponding number of ethmoidal turbinate bodies. Above and behind these one to three oblique fissuræ ethmoidales is a nearly vertical depression between the posterior end of the inner surface of the lateral mass and the anterior surface of the body of the sphenoid, known as the recessus speno-ethmoidalis, into which opens the ostium sphenoidale. (Plates 2, 8, 18.) Into the fissuræ ethmoidales open the posterior ethmoidal cells by means of comparatively large foramina known as ostia ethmoidalia. (Plates 4, 8, 34, 39, 51.)

The region above and posterior to the superior border of the inferior ethmoidal turbinate belongs to the domain of the posterior ethmoidal cells, and need not concern us further.

*Inferior Ethmoidal Turbinate (middle turbinate of nose).—*The lamina of bone forming the internal boundary of the labyrinth, as already noted, is divided sufficiently for descriptive purposes into two triangles by the incisura ethmoidalis inferior and a line projected forward to the antero-superior angle at the nasal process of the superior maxilla. (Plates 2, 3, 29.) The surface of the superior of these triangles is interrupted by the remaining fissuræ ethmoidales, which indicate the number of ethmoidal turbinate bones. This triangle does not concern us.

The inferior triangle is the inferior ethmoidal turbinate

bone, a thorough understanding of which is of importance in the treatment of anterior ethmoidal and frontal sinus disease. This lamina of bone hangs with a free border which projects into the nasal cavity (Plates 20, 57), and presents two surfaces, three borders, and three angles for consideration.

The inner surface faces the septum nasi, is flattened above but convex below, particularly in the antero-posterior direction, on account of the curling outward of the lower portion of the bone. (Plate 62.) It is roughened throughout its whole extent, and grooved near its inferior border for the branches of the sphenopalatine artery, which run forward and upward. The bone, as a whole, is rather spongy, but occasionally its surface is smooth. Corresponding to the length of the fissura ethmoidalis inferior, the surface here makes a right angle, or the bend may be even more acute, so that the upper portion of the inner surface no longer presents towards the septum nasi, but looks upward. (Plates 29, 30, 75.) This portion of the turbinate may be twelve millimetres to twenty millimetres long, and about ten millimetres wide, and its direction is of value in causing pus from the posterior ethmoid cells and sphenoidal sinus to flow backward towards the pharynx.

The outer surface of this ethmoidal turbinate is concave, but somewhat flattened towards the superior angle. This external concavity is called the sinus of the turbinate, and it is in very constant relation to the bulla ethmoidalis and processus uncinatus, as will be described later. (Plates 67, 69, 70.) This surface is often rougher than the internal aspect of the turbinate, and characterized by depressions or pockets even of considerable size. The openings of these depressions may become constricted, thus giving rise to cell-like formations resembling the ethmoidal cells. There may be a single large cell or more commonly several smaller cells, all of which open into the space below and external to the inferior ethmoidal turbinate, known as the middle meatus of the nose. (Plates 57, 58, 68.)

The superior border is the longest, and has a bony at-

tachment throughout its whole extent. Starting from the sphenopalatine foramen, it passes upward and forward across the superior turbinated crest of the palate bone, thence obliquely along the cells of the labyrinth, to reach the lamina cribrosa in front, then it is carried forward close to the median line, often in contact with the lamina perpendicularis and thickened inferior border of the frontal septum, to terminate on the inner surface of the nasal process of the superior maxilla. (Plates 4, 8, 10, 11, 29, 30, 34, 45.)

The anterior and shortest border of the turbinate begins at this point, is carried downward for a variable distance on the nasal process of the maxilla, commonly in conjunction with the anterior extremity of the uncinat process. The lower half of the anterior border bends a little backward, and continues to the inferior angle as a free border.

The inferior border is free and connects the inferior and posterior angles. (Plates 2, 3, 29, 30.) It is much thickened, curled outward, spongy, and traversed by small canals for vessels.

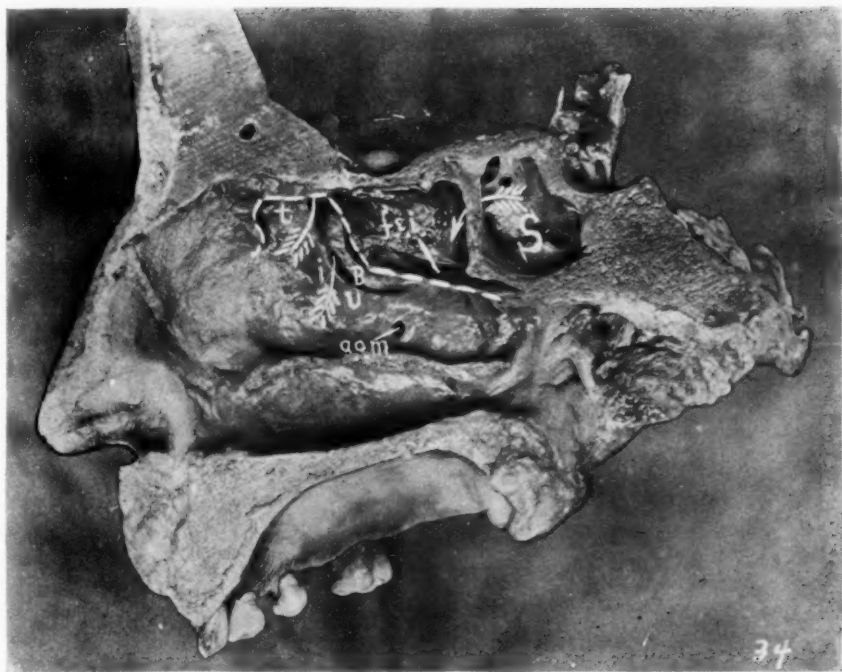
The posterior angle is at the junction of the superior and inferior borders, and is just below the sphenopalatine foramen, and on nearly the same vertical plane as the posterior angle of the inferior turbinate bone.

The superior angle is somewhat obscurely placed near the roof of the nasal fossa, internal to the ostium frontale. The space just external to this angle is frequently somewhat enlarged by carrying the anterior border forward on to the nasal process of the superior maxilla and increasing the concavity of the turbinate, so as to assume considerable importance on account of the openings from the frontal sinus, the frontal bulla, and anterior ethmoidal cells. This forward prolongation of the cavity under cover of the turbinate is called the *agger nasi* by H. Meyer, and is comparable with an extra turbinate, as observed in some of the lower mammalia. (Plates 8, 12, 25, 30, 40, 51, 52, 58, 59, 65.)

The anterior angle is often very prominent, projects freely into the nasal cavity, and is formed by the junction of



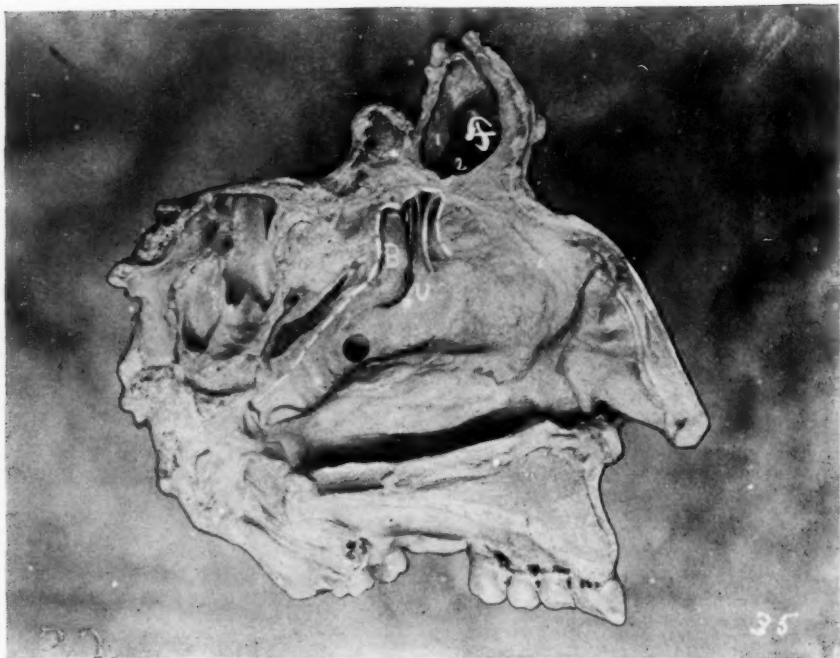
Plate 34.



RIGHT NASAL FOSSA, MIDDLE TURBINATE REMOVED.

*t.* Turbinate fossa leading to frontal sinus. Arrow. *B.* Small ethmoid Bulla. *U.* Uncinate process. *f.e.i.* Fissura ethmoidalis inferior, in which may be seen ostia of posterior ethmoidal cells. *S.* Sphenoidal sinus opening into recessus Spheno-ethmoidalis. *i.* Arrow disappearing through Hiatus frontalis into Infundibulum. *a.o.m.* Accessory Ostium maxillare.

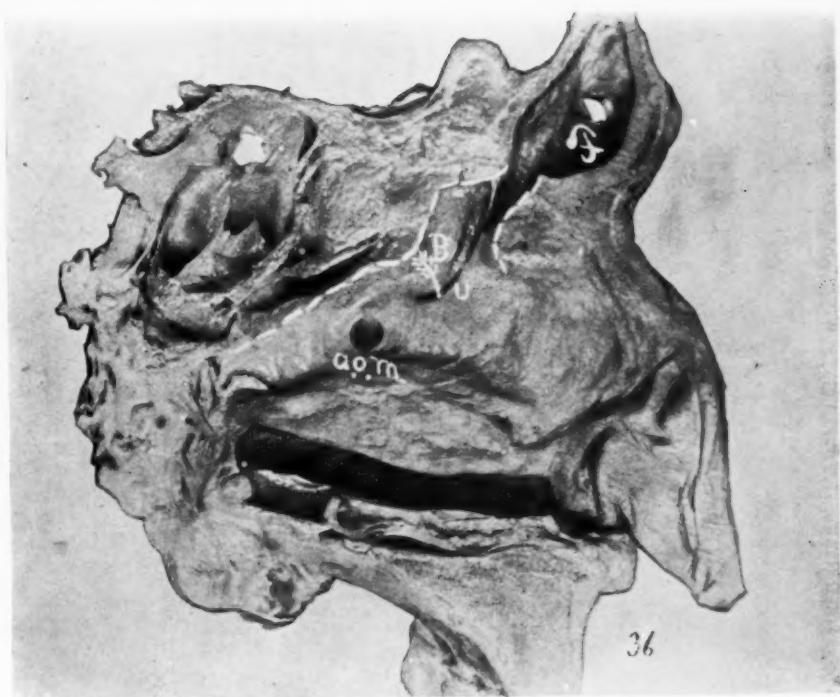
Plate 35.



LEFT NASAL FOSSA, EXTERNAL WALL, MIDDLE TURBINATE REMOVED, SHOWING  
ABSENCE OF SEPTUM BETWEEN BULLA ETHMOIDALIS AND UNCINATE  
PROCESS, WHEREBY THE TURBinate FOSSA AND UPPER END  
OF INFUNDIBULUM COINCIDE.

*F.* Frontal sinus. *B.* Bulla ethmoidalis. *U.* Uncinate process. Hiatus semi-lunaris between these two, in which can be seen a small probe, (1) passing from the *Antrum to the Frontal Sinus*. Large probe, (2) passing from sinus through a second ostium frontale appearing just under the middle turbinate bone. A small septum can be seen between these probes, which separates ostia of anterior ethmoidal cells. Accessory ostium maxillare of large size, to be seen just above inferior turbinate bone. See Plate 36.

Plate 36.



SAME SPECIMEN ENLARGED, MORE OF THE TURBINATE BONE REMOVED, SHOWING FREE PASSAGE TO FRONTAL SINUS. ARROW LEADS TO OSTIUM MAXILLARE.

*a.o.m.*, Accessory ostium maxillare.

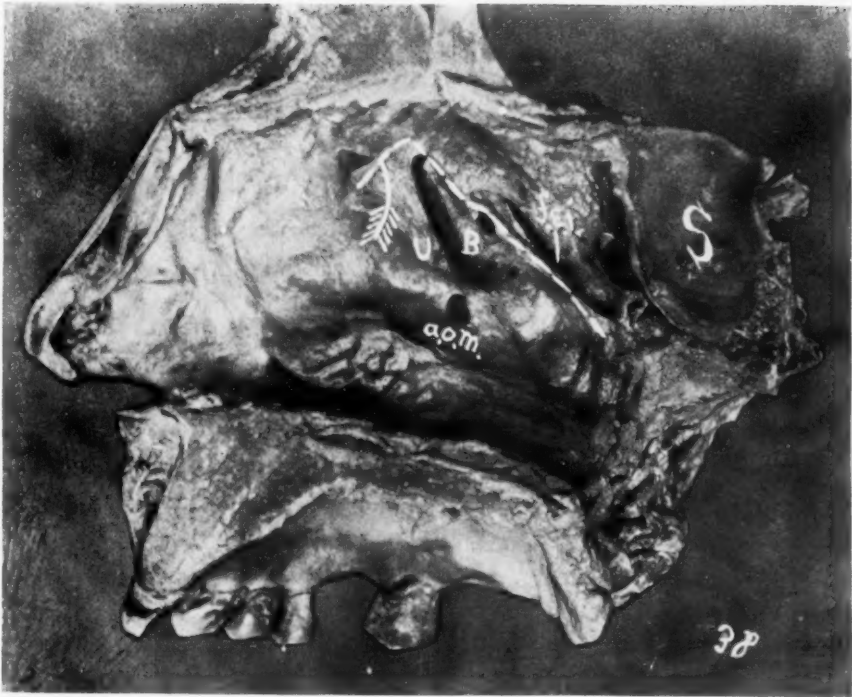
Plate 37.



LEFT NASAL FOSSA, EXTERNAL WALL, TURBINATE BONE REMOVED. PROBE  
FROM TURBINATE FOSSA TO FRONTAL SINUS. ARROW IS LOST IN  
INFUNDIBULUM UNDER SEPTUM BETWEEN BULLA ETHMOI-  
DALIS AND UNCINATE PROCESS. LOWER PORTION  
OF HIATUS SEMI-LUNARIS OBSTRUCTED BY  
A SMALL POLYP (*p*) WHICH HANGS  
FROM THE ETHMOID  
BULLA (*B*).

*f.e.i.* Fissura ethmoidalis inferior. *F.* Frontal sinus. *f.b.* Frontal Bulla.

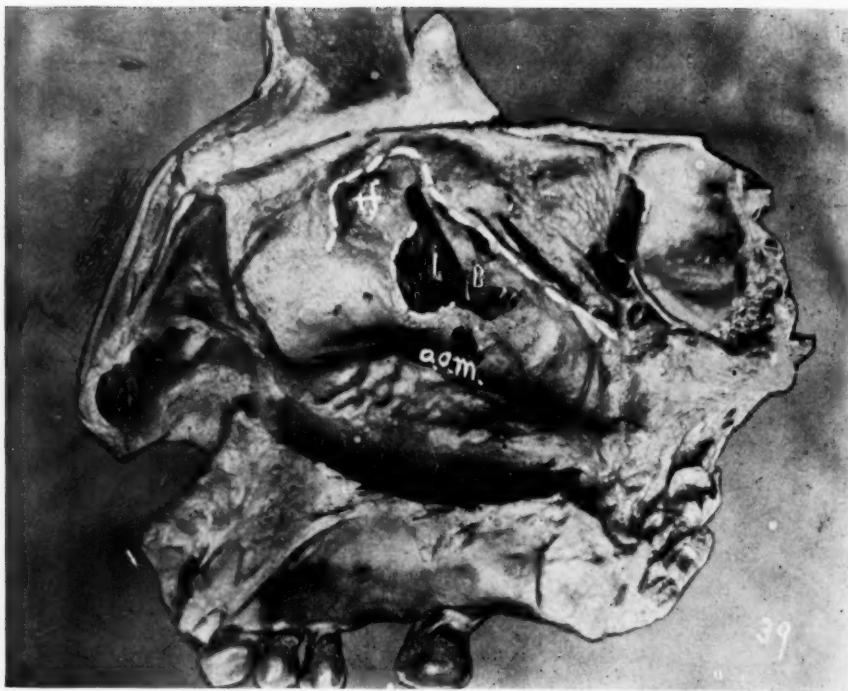
Plate 38.



RIGHT NASAL FOSSA, EXTERNAL WALL, MIDDLE TURBinate REMOVED WITH  
ARROW LEADING TO TURBinate FOSSA, WHICH ENDS BLINDLY UNDER  
THE SUPERIOR ANGLE OF THE TURBinate.

*B.* Bulla ethmoidalis, with its Ostium. *U.* Uncinate process. Well marked  
Hiatus Semi-lunaris between these two structures leading to Infundibulum; into  
which opens the naso-frontal canal. *a.o.m.* Accessory Ostium maxillare. *f.e.i.*  
Fissura ethmoidalis inferior. *S.* Sphenoidal Sinus. See Plate 39.

Plate 39.



SAME SPECIMEN, MORE OF THE TURBinate BONE REMOVED, EXPOSING THE TURBinate FOSSA.

*t.f.* Turbinate fossa. Portion of Uncinate process removed showing depth of Infundibulum at the lowest point of which is a small probe in the Ostium maxillare. On the external wall of the Infundibulum are small cell-like cavities. *a.o.m.* Accessory Ostium maxillare. *B.* Bulla ethmoidalis, with its ostium just above. *i.* External wall of Infundibulum.

the inferior and anterior borders. This projecting flap-like portion of the turbinate is known as the operculum (Schwalbe), and is commonly removed in attempts to reach the frontal sinus and anterior ethmoidal cells from within the nasal cavity. (Plates 29, 30.)

The general outline of the inferior ethmoidal turbinate is somewhat variable, yet it never loses its triangular shape. The free portion of the anterior border may be long or short, in which case the operculum is more or less prominent, and the angle formed by the anterior and inferior borders acute or obtuse. A long anterior border lowers this angle and renders access to the labyrinth more difficult. The general plane of the turbinate is a vertical one, but it may be deviated strongly to one side or the other, thus lying in contact with the septum nasi, on the one hand, or be crowded against the labyrinth, on the other hand. (Plates 57, 59, 61.) Its normal, external concavity may be greatly exaggerated, and thus impinge upon the labyrinth. The space between the anterior border of the turbinate and the nasal process of the superior maxilla will be accordingly narrow or wide, to the operator's advantage or hinderance.

Now and then one or more deep furrows traverse the inner surface more or less parallel to and near the lower border, so as to give one the impression of the presence of an extra turbinate when viewed from the anterior nares. The lower border may be much thickened, or greatly rolled up externally, to form a sort of gutter along the lower edge of the sinus of the turbinate. (Plates 59, 60, 62.) Deep notches not infrequently interrupt the general contour of the free margin. Very rarely is the internal surface of this turbinate concave.

The formation of cells in the inferior ethmoidal turbinate has been considered in connection with the external concave surface (sinus), appearing in grades from simple niches to well-formed cells, having distinct ostia, which open into the middle meatus. This is the smaller and unusual variety of well-marked cell. In about 200 observations, turbinate cells

were present in 18 per cent. of the cases. One-third of these were of the variety arising from the turbinate sinus, two-thirds were cells differing in character and mode of origin, as well as location of their ostia.

This latter variety is characterized by the presence of one large cell rather than several smaller ones, is located more commonly near the anterior border, which may be eight millimetres to twelve millimetres wide. (Plates 45, 58, 65, 68, 70, 71, 80.) The turbinate may consequently fill up the space between the septum nasi and bulla ethmoidalis, or grow at the expense of either of these structures. Of these larger cells, two-thirds open above the inferior ethmoidal turbinate into what is commonly called the superior meatus of the nose. To be exact, there is usually a single ostium, and that is located on the superior border of this turbinate at the anterior extremity of the fissura ethmoidalis inferior, occasionally in common with one or more of the posterior ethmoidal cells. It is important to note that the ostium is at the apex of the cell, most unfavorable for drainage, and would discharge into the superior meatus in two-thirds of the cases, in common with the posterior ethmoidal cells and the sphenoidal sinus.

The cell may occupy a part of the turbinate only; or occupy the greater portion of it, when it has received the name of *concha bullosa*. The extent of the cell can be determined during life by means of the probe.

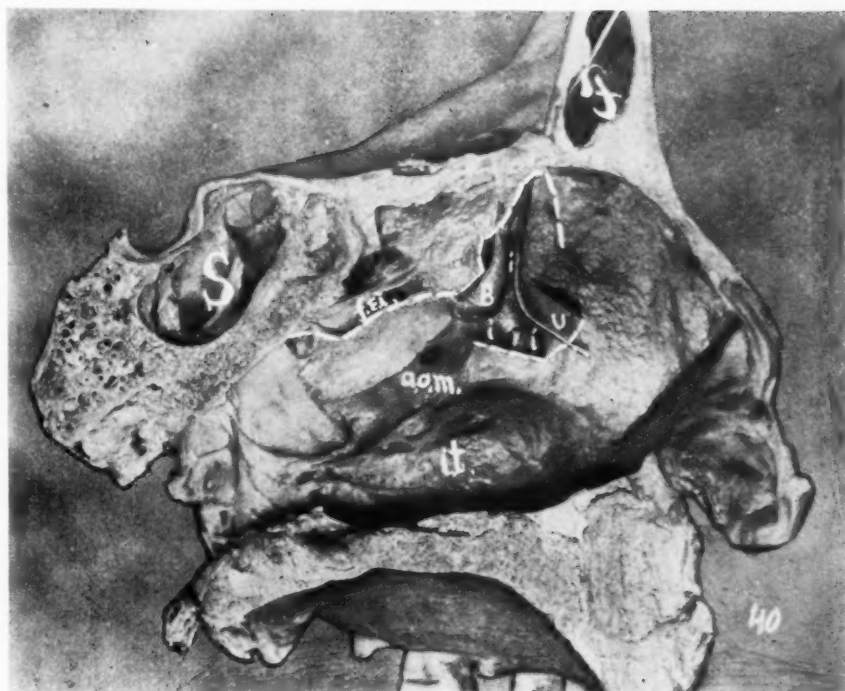
The remaining ethmoidal turbinate bones are situated above and behind the region under consideration (Plates 29, 30), therefore they do not concern us.

So much for the lateral and anterior boundaries of the lateral mass, and we have now to consider the structures between these walls and their relation to the inferior surface (nasal portion) of the frontal sinus.

*Processus Uncinatus*.—The *processus uncinatus* (Plates 4, 5, 8, 9, 11, 22) is a portion of the ethmoid bone consisting of a narrow, flattened, and somewhat curved bony lamella, which presents two surfaces, two borders, and two extremi-



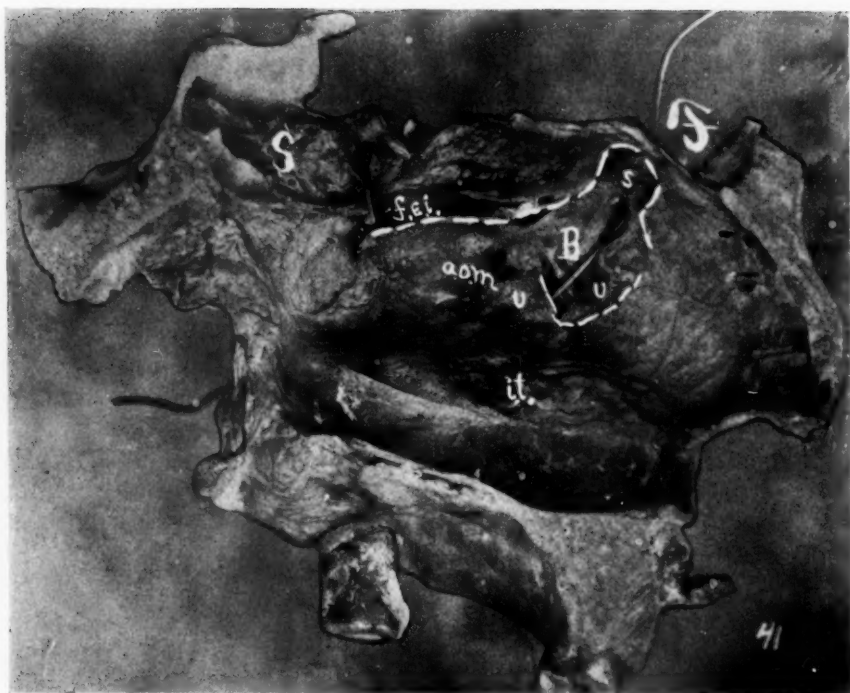
Plate 40.



LEFT NASAL FOSSA, EXTERNAL WALL, MIDDLE TURBINATE REMOVED. UNCINATE PROCESS INCISED, AND ITS UPPER PORTION REFLECTED FORWARD AND RETAINED IN POSITION BY A PROBE PASSING DOWN FROM THE FRONTAL SINUS INTO THE INFUNDIBULUM. A SHORT PROBE SHOWS THE LOCATION OF THE OSTIUM MAXILLARE.

*a.o.m.* Accessory Ostium maxillare. *U.* Reflected portion of Uncinate process. *B.* Bulla ethmoidalis, with a long ostium above. *f.e.i.* Fissura ethmoidalis inferior. *S.* Sphenoidal sinus. *i.t.* Inferior turbinate. *i.i.i.* Infundibulum. *F.* Frontal sinus.

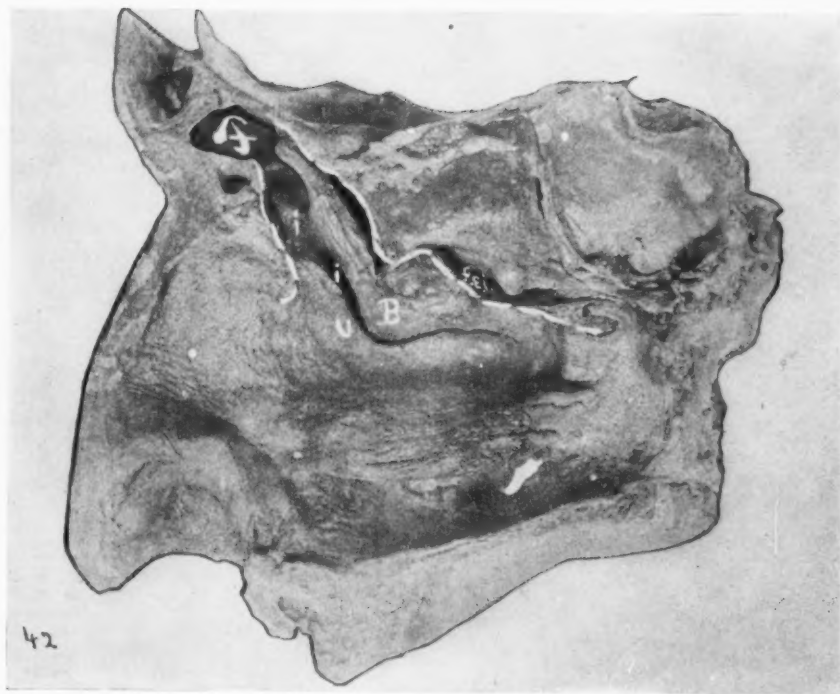
Plate 41.



LEFT NASAL FOSSA. EXTERNAL WALL, MIDDLE TURBINATE REMOVED, UNCINATE PROCESS DIVIDED AND UPPER PORTION REFLECTED FORWARD AND INWARD. PROBE PASSED FROM FRONTAL SINUS TO ANTRUM THROUGH NASO-FRONTAL CANAL AND INFUNDIBULUM SHOWING ITS DEPTH AND THE TENDENCY OF FLUIDS TO GRAVITATE INTO THE ANTRUM.

*B.* Bulla ethmoidalis with its Ostium just above. *u.u.* On portions of uncinates process. *a.o.m.* Accessory Ostium maxillare. *f.e.i.* Fissura ethmoidalis inferior. *S.* Sphenoidal sinus. *F.* Frontal sinus broken away. *s.* Septum between uncinates process and Bulla ethmoidalis separating a blind turbinate fossa from the upper extremity of the Infundibulum.

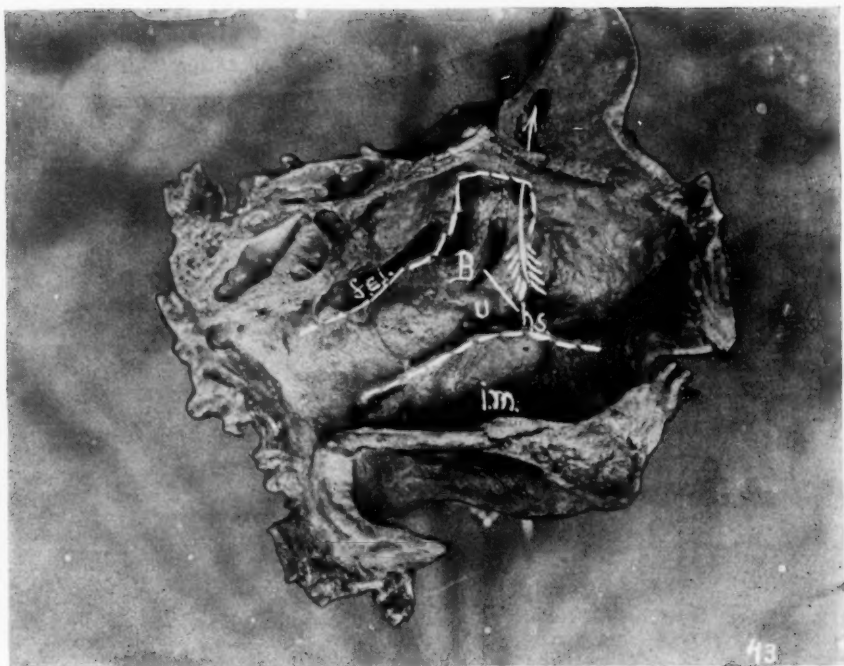
Plate 42.



RIGHT NASAL FOSSA, EXTERNAL WALL; MIDDLE TURBinate AND PART OF FLOOR OF FRONTAL SINUS REMOVED, SO AS TO SHOW A DIRECT COMMUNICATION BETWEEN THE INFUNDIBULUM AND SINUS.

*B.* Bulla ethmoidalis, very large and overhangs the Uncinate process, so as to obscure the Hiatus Semi-lunaris, its long ostium continued well toward the frontal sinus; its mucous membrane is considerably hypertrophied. *U.* Processus Uncinatus. *i.i.i.* Infundibulum. *f.e.i.* Fissura ethmoidalis inferior, above which hangs a small polyp. *F.* Frontal Sinus. See Plate 44.

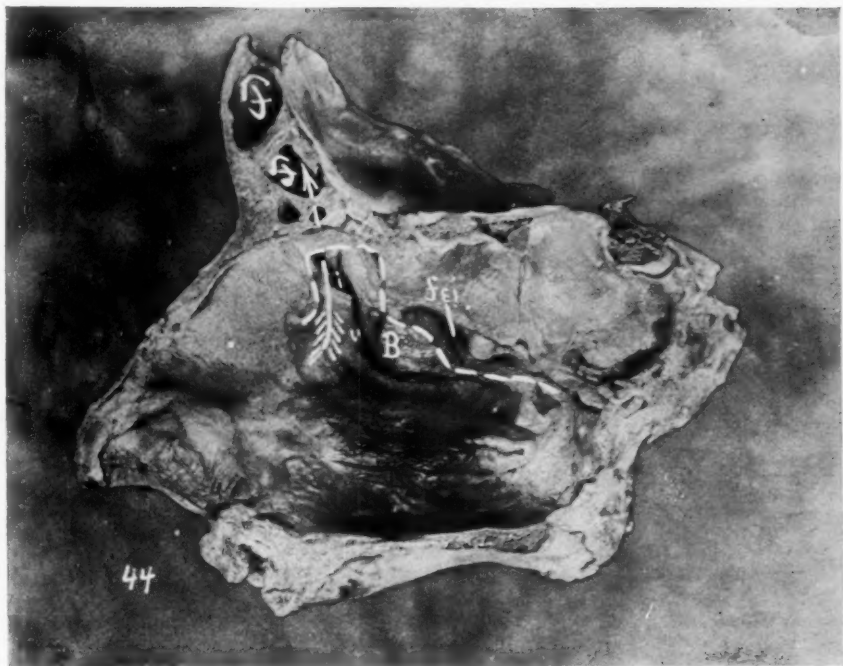
Plate 43.



LEFT NASAL FOSSA, EXTERNAL WALL, MIDDLE AND INFERIOR TURBINATES REMOVED ALONG DOTTED LINES. ARROW THROUGH TURBINATE FOSSA TO FRONTAL SINUS.

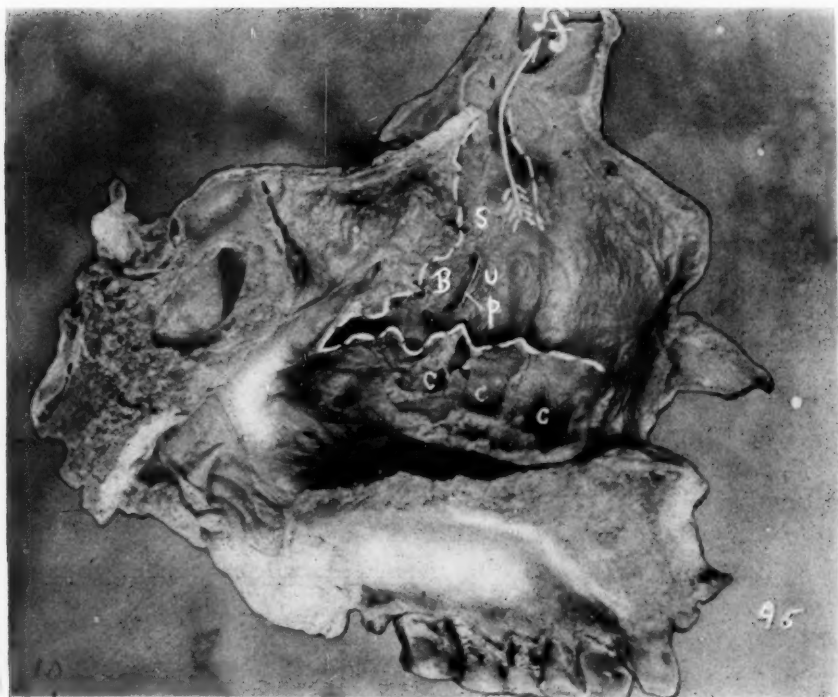
*B.* Bulla ethmoidalis, rather small with large ostium above. *h.s.* Hiatus Semi-lunaris narrowed below by the approximation of the Bulla ethmoidalis and processus Uncinatus (*U*). *f.e.i.* Fissura ethmoidalis inferior. *i.m.* Inferior meatus.

Plate 44.



SAME SPECIMEN (REDUCED IN SIZE) AS PLATE 42, LESS OF MIDDLE TURBINATE  
REMOVED; FIGURES CORRESPOND TO THOSE IN PREVIOUS PLATE.  
ARROW PASSES TO FRONTAL SINUS THROUGH  
HIATUS SEMI-LUNARIS.

Plate 45.



LEFT NASAL FOSSA, EXTERNAL WALL, MIDDLE TURBinate BONE PARTIALLY SEVERED AND HANGING IN FRONT OF INFERIOR TURBinate. ARROW PASSES THROUGH TURBinate FOSSA TO FRONTAL SINUS.

*F.* Frontal Sinus. *S.* Broad Septum, from Uncinate process to Bulla ethmoidalis, forming the inner wall of the turbinate fossa. *c.c.c.* Cells in middle turbinate bone. *p.* Fine probe in small Hiatus Semi-lunaris. *B.* Bulla ethmoidalis, very small. *U.* Processus Uncinatus, very small.

ties. Its anterior extremity is attached to the anterior portion of the lateral mass of the ethmoid, in close proximity to the upper part of the anterior border of the inferior ethmoidal turbinate bone. (Plate 18.) From this point the process takes a direction downward, backward, and a little outward in a plane external to the turbinate bone, but the inferior border of the process follows quite closely, in many instances, the contour of the free margin of the turbinate.

An understanding of the relations of this process and the septa connected with it, is of extreme importance, for these conditions determine in part the formation of the ducts and orifices pertaining to the frontal and maxillary sinuses, as well as many of the anterior ethmoidal cells. The plane of the bone is somewhat vertical, but its lower end is a little twisted, so that each surface faces in three directions. This tilting of the process, in conjunction with the bulla ethmoidalis, and their mucous membrane connections, to be described presently, is an important determining factor in directing the flow of pus from the frontal sinus and some of the anterior ethmoidal cells.

*Internal Surface.*—The internal or nasal surface of the uncinate process faces inward, and to a lesser degree forward and downward. Its anterior portion is united for a variable distance to the outer surface of the anterior end of the inferior ethmoidal turbinate, and in conjunction with this it is carried forward to articulate with the posterior border of the nasal process of the superior maxilla, and thence to the inner surface of this process. (Plates 8, 11.) According to the extent of union between these approximated surfaces of the processus uncinatus and turbinate will be determined one of the modes of approach to the floor of the frontal sinus. With the exception of this small anterior portion, the rest of this surface is free, and forms part of the outer wall of the nasal fossa, just posterior to the nasal process of the superior maxilla, part of the lachrymal bone, and lachrymal process of the inferior turbinate. There may be a space here, however, but the continuity is restored by mucous membrane.

This surface passes down external to the operculum of the turbinate with a varying distance between them. (Plate 65.)

*External Surface.*—The external or infundibular surface faces outward principally, and to a lesser degree upward and backward. Its anterior portion is beautifully exposed on removal of the lachrymal bone, and viewing the surface from the orbital fossa. (Plates 5, 7, 9.) At once thin, irregular laminae of bone come to view, connected with this surface so as to form broken, cellular spaces, which, when articulating with the corresponding slightly raised ridges already described on the internal surface of the lachrymal bone (Plate 27), complete certain of the anterior ethmoidal cells. Hence, external to this portion of the external surface are ethmoidal cells and lachrymal bone. Very soon, however, this surface becomes the inner wall of the infundibulum, soon to be considered at length, into which this group of cells usually opens. For the rest of its extent this outer surface, in the bony state, is seen to cross the margin of the orbital surface of the superior maxilla without touching it (Plate 9), and then to face the antrum of Highmore. In the recent state, before the mucous membrane is disturbed, this surface forms the inner wall of the infundibulum, and is shut off from the inner wall of the antrum, except at its lowest portion, whence various processes radiate to be attached or not, as the case may be, to the periphery of the bony outlet of the antrum, thus partially completing the inner antral wall. Aside from these slender bony processes, the processus uncinatus projects sickle-like nearly across the hiatus maxillaris, and distally helps form part of the wall of the antrum. (Plates 4, 8, 9, II.)

(TO BE CONTINUED.)



A CASE OF COMPLETE CROSS LESION OF THE  
SPINAL CORD DUE TO A FRACTURED DIS-  
LOCATION, THE FIFTH CERVICAL  
VERTEBRA BEING DISPLACED  
FORWARD UPON THE  
SIXTH.

By GEORGE W. CRILE, M.D.,

OF CLEVELAND, OHIO,

PROFESSOR OF PRINCIPLES OF SURGERY, CLEVELAND COLLEGE OF PHYSICIANS AND  
SURGEONS; SURGEON TO ST. ALEXIS'S AND CLEVELAND GENERAL HOSPITALS.

THE patient was under observation at the Cleveland General Hospital from the twenty-fourth to the ninety-third hour. Drs. Coe, Page, and Fenton made observations on the case during the first twenty-four hours. The patient was a male, forty-six years old, a farmer, in good health, whose personal and family history had no bearing upon the case. While riding on an empty lumber wagon he fell backward to the ground, a distance of not more than three feet, striking upon his head, forcing his head forward upon his chest. He was not unconscious, and experienced an indescribable feeling coming over him on the instant of the fall. He was immediately paralyzed in the trunk and in the lower extremities. There was but little immediate pain. He did not remember any crack or giving way in the vertebral column. After the fall there was pain and tenderness in the shoulders, arms, and hands, and considerable soreness in the neck. There was pain on moving the neck, the head was held rather towards the left. There was at no time headache. His appetite was good. He slept fairly well and had no cramps or jerkings.

*Head and Neck.*—The head was held steadily, slightly rotated on the vertical axis, towards the left. The horizontal axis

undisturbed. The head was moved from side to side without much pain. Likewise there was an antero-posterior movement, his face was somewhat congested, but this may have been due to sun exposure. The innervation of the muscles of the skin of the head and neck was normal. Special senses normal.

*Eyes.*—The palpebral slits were much narrowed. The pupils contracted down to a very small size. They slightly responded to light, but more actively to accommodation. The ocular movements were normal. The eye-ground was examined by Dr. A. R. Baker. The veins were much dilated, the arteries and other structures normal. The eye symptoms remained practically unchanged during his stay in the hospital.

*Genito-Urinary Organs.*—There was retention of urine, and the patient was catheterized every six hours. During the second twenty-four hours there were eighteen ounces secreted; the third twenty-four hours, eighteen ounces; the fourth twenty-four there were fifty-four ounces. On analysis, on the second day, the urine was found normal, specific gravity 1016. On the third day there was mucus and bladder epithelium, the urine was cloudy. On the fourth day there was increased amount of mucus and epithelium. There was no albumen in quantity. There was no priapism. During the second twenty-four hours the glans became red, and there was some discharge of pus. This discharge was noted during his stay in the hospital. The organ was slightly enlarged. On the second twenty-four hours patient thought he experienced a slight feeling of fulness in the bladder. The testicles were rather dusky red. The cremaster reflex was not apparent in the second twenty-four hours, but was present in the third and fourth days. Both sides were alike. The sphincter vesicæ was of good tone, the bladder tone fairly good.

*Digestive Tract.*—The appetite and digestion quite good. The bowels constipated. On digital examination the sphincter ani was found to be probably a little under the normal tone.

*Reflexes.*—The abdominal reflexes were all absent. The tendon reflexes absent. The plantar reflex was manifested by a slight movement of all the toes. Arm reflexes absent. Vasomotor: The tache cérébrale was very marked over the entire area of paralysis.

*Anæsthesia.*—On the twenty-fifth hour there was total pain anæsthesia from the level of the middle of the second intercostal

space downward. The upper line of the anæsthesia extended along the border of the pectoralis major, down the arm, along the anterior surface of the elbow at the junction of the middle and the outer thirds, deviating slightly outward to the middle of the forearm, thence parallel along the middle of the ulna to the wrist, then defining the palmar border of the thenar eminence, up the internal line of juncture between the palmar and the dorsal aspects of the thumb, along the free border of the nail, descending along the border between the palmar and dorsal aspects, passing along the outer border, parallel with the radius. In the middle of the forearm it deviated inward, and passed over the elbow-joint in the outer third, thence along the biceps muscle, and at the juncture of the upper and middle thirds of the arm swept outward and backward across the scapula, on the left side eleven centimetres from the highest point of the middle of the shoulder, across the shoulder, and back in an undulating curve. On the right shoulder, nine centimetres below the highest point in the middle of the shoulder, across upon the right arm at its middle and upper thirds, where it passed into the border of the biceps, which it then passed, over the elbow surface in the outer third parallel in the radius, but on its inner border to the wrist, extending along the outer border of the thenar eminence to the metacarpo-phalangeal joint, then passing around along the inner border of the thenar, around to the ulnar side of the wrist, along the middle of the ulnar aspect, and parallel to the middle of the arm, thence across to the juncture of the middle and outer thirds of the anterior aspect of the elbow, passing upward along the inner border of the biceps one inch above the anterior axillary fold; thence across the chest in the second intercostal space. While the outline in most places was sharp, the line was somewhat wavering and bounded by a zone of lessened sensibility before the insensibility was reached.

Heat and cold, tactile and pressure, were well defined.

Relative dimensions of the areas of normal sensation on the corresponding sides. Right side: Thenar eminence, four centimetres; at the wrist, seven centimetres; forearm, nine centimetres; elbow, seven centimetres; middle of arm, seven centimetres; top of shoulder down to the anæsthesia line, on the arm, seventeen centimetres; crest of middle of shoulder to the chest line, seventeen centimetres; crest of middle of shoulder to back,

nine centimetres. Left side: Thenar eminence, four centimetres; at the wrist, seven centimetres; forearm, eight centimetres; elbow, eight centimetres; middle of arm, seven centimetres; top of shoulder down to the anæsthesia line, on the arm, fifteen centimetres; crest of middle of shoulder to the chest line, seventeen centimetres; crest of middle of shoulder to back, twelve centimetres.

Arrangement of the anæsthetic lines from below upward. (1) Pressure: Deep pressure was appreciated as such along an irregular border, several inches wide, in places peripheral to that of touch. (2) Pain: On right chest about an inch lower than that of heat and cold. (3) Heat and cold were the highest, but on the left side there was not so much difference between the boundary of the heat and cold anæsthesia and that of pain as on the right side.

The touch sense on the thumb was longer retained than the pain, as was also the pressure sensation,—that is to say, in the progress of the lesion pain sensation was lost before the sensation of touch and that of pressure. There was no hyperæsthesia and no paræsthesia. On the second day the patient thought he perceived slightly bladder fulness.

*Motion.*—Right arm: There was total loss of motion, except in the action of the flexors of the forearm and the slight rotator and supinator action. The latter was lost after the second day. The deltoid was practically paralyzed, could be felt to contract slightly. Abduction and adduction of the arm were lost. External and internal rotation of the humerus lost. The shoulder could be moved in the following directions: backward, forward, upward, and downward. All these quite vigorously. Left arm: Pronation and supination of the forearm active. Deltoid rather feeble, but stronger than the right. Flexor of the forearm vigorous. Internal and external rotation of the humerus. Adduction and abduction weak. All the shoulder movements necrosed. The pectoralis and the latissimus dorsi paralyzed. All intrinsic muscles of the upper extremity completely paralyzed, excepting the pronators and the supinators of the left forearm. Flexors of both forearms and the shoulder muscles of both. The movements grew weaker day by day.

*Status on the Sixtieth Hour.*—Touch on the left side bounded by the seventh rib. Pressure slight in the entire left leg, in-

creasing in distinctiveness upward. Touch on the right side on a level with the nipple. Cremaster reflex more marked on the left side. Pressure sensation perceived over entire left thumb, touch sensation to the end of the proximal phalanx of the thumb. Pain at a point one inch above the carpal joint. Touch was more acute on the anterior than on the posterior surface. There is hyperæsthesia of the entire bone area. There is an area of confusion about an inch in width in which cold was mistaken for heat, but heat was never mistaken for cold.

Motion in the right arm slight; biceps action in left arm, supination and pronation and flexion, brisk.

The following notes were made by Dr. H. M. Page, after the patient had returned to his home: On July 29, 1897, shows pressure on right side over fourth rib; touch on right side over third interspace; pain on right side over second interspace. Pressure on left side over third rib; touch on left side over fourth rib; pain on left side over third rib. Distinguishes heat and cold from sixth rib up on both sides. Pain, touch, temperature, and pressure over flexor surface of left arm; wanting on extensor surface. Movement in deltoid and supinator longus on left side; wanting on right. Pain, touch, pressure, and temperature senses over flexor surfaces of right arm; wanting on extensor surfaces. Hypochondrium reflexes present; pupils normal; vision normal. Complains of smarting sensation at site of bed-sores in sacral region. Bed-sores worthy of note did not appear until three weeks after accident. Does not sweat below third rib; excessively above. Claims to feel sun's rays over lower surface of body; appetite good; voice strong. Mental faculties unimpaired. Heart's action normal. All reflexes absent below third rib except hypochondrium; slight cremaster and an action of levator ani muscle on irritation of bed-sore in sacral region. Atrophy not marked. Vasomotor disturbance not marked. He was injured May 11, 1897, and died August 23, 1897, from inspiratory failure; the heart continued to beat for a time after respiration ceased.

*Post Mortem.*—With the assistance of Dr. Coe, in the presence of Drs. Page and Fenton, a post-mortem examination was made. The body was found much emaciated. There were extensive bed-sores, and at one time the bones of the sacrum and the lower lumbar vertebra were exposed, but some time before

his death granulations had sprung up to a considerable extent, covering them over. The neck was found fairly freely movable upon all its axes of motion. On making the dissection, it was found that the fifth cervical vertebra was displaced forward upon the sixth.

There was a fracture of the tips of the facets of the trans-



FIG. 1.—Spinal column sawed vertically, showing the forward displacement of the fifth upon the sixth vertebra.

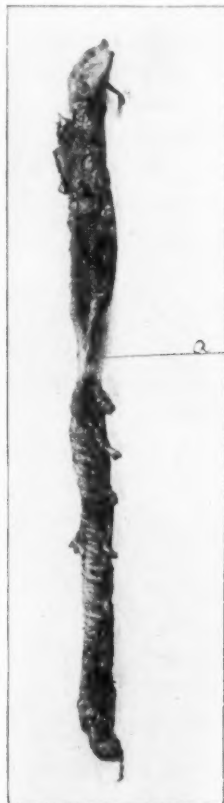


FIG. 2.—Spinal cord showing (a) the point of compression.

verse processes of the vertebra, and there was a chipping off of the anterior margin of the bottom of the sixth vertebra, the ligaments attached to the spinous process between the fifth and sixth were torn. The neck was doubtless so far bent forward upon the chest as to tear these ligaments and raise the lateral pro-

cesses sufficient to escape those with which they articulated, and when in that position the fifth vertebra slipped forward upon the sixth, and then, as the neck was brought back, the transverse processes of the fifth dropped back anterior to the transverse processes of the sixth, so that in the case of the fifth the transverse processes were anterior to both those of the fourth and of the sixth, leaving the entire fifth and all the vertebræ above it carried forward upon the vertical axes. As a result, there was total cross lesion of the spinal cord at that point. The cord itself, as is seen in the cut (Fig. 2), was completely compressed, and when held up to the light it was easily seen that there was nothing left at the point of pressure excepting connective tissue coverings, and, on dissection, it was found that only the coverings of the cord were left. The lesion then was an immediate total transverse lesion.

## TRANSACTIONS OF THE NEW YORK SURGICAL SOCIETY.

*Stated Meeting, May 25, 1898.*

The President, ANDREW J. MCCOSH, M.D., in the Chair.

### EXCISION OF HEAD OF HUMERUS FOR DISLOCA- TION.

DR. C. L. GIBSON presented a man, sixty-eight years old, who, in April, 1897, fell and sustained a dislocation of the left shoulder. Immediately after the accident an attempt was made to reduce the dislocation under an anæsthetic, but failed. After several other unsuccessful attempts had been made, the man was taken to St. Luke's Hospital (in May, 1897), where Dr. Gibson first saw him. He found an unreduced subcoracoid dislocation of a marked degree, the man being scarcely able to move his arm at all. Under ether, various methods of reduction were attempted, but without avail. An open operation was then done, and, even after exposing the head of the humerus, it was found very difficult to reduce it on account of the firm adhesions. The greater tuberosity was split and adherent to the capsule, and the latter was so much disintegrated that it was deemed best for the patient to remove the head of the humerus. This was accordingly done through the surgical neck. The wound closed without any trouble, and the functional result of the operation was very good. There is still, however, considerable limitation of motion, as the man cannot raise the arm to a horizontal level nor carry it backward, and rotation is also somewhat limited.

### EXCISION OF THE KNEE FOR TUBERCULOSIS IN AN ADULT.

DR. F. TILDEN BROWN presented a man who fell from a tree four years ago, injuring his knee, which gradually became the seat of disease. When the patient came under Dr. Brown's observation, a year ago, the symptoms of tuberculosis of the



knee were unmistakable, and the joint was in such a condition that excision was resorted to. A very satisfactory functional result was obtained. At present there is a marked forward dislocation of the femur.

#### COMPOUND DISLOCATION OF THE ANKLE IN A MAN SEVENTY YEARS OF AGE.

DR. BROWN presented a man, seventy years old, who, about a year ago, caught his foot in a moving wheel, producing a compound fracture and dislocation of the right ankle-joint. When Dr. Brown first saw the case there was an ulcerating wound about four inches in length, through which the articular end of the fibula protruded. Although an exsection was indicated, the man's general condition was so poor that it was decided to reduce the dislocation. This was done by incising the deeper parts of the wound, taking out some of the comminuted fibula, inserting a drain, and then putting up the limb in plaster. The dressing was left on for fourteen days, during which time there was much foul discharge. The dressing was then renewed weekly. After six weeks there was no union and some of the tendons showed signs of sloughing. After two months union was manifest, and the man was discharged with almost complete ankylosis of the joint, but with ability to make fair use of the limb. The wound has closed entirely.

#### OPERATION FOR PROLAPSE OF ILEUM THROUGH THE UNCLOSED DIVERTICULUM OF MECKEL IN AN INFANT.

DR. CHARLES K. BRIDDON presented an infant who was born in the eighth month and a half of pregnancy. It defecated entirely through the normal outlet for the first ten days after birth, when the alimentary contents began to pass through the unclosed umbilicus. The discharge from the preternatural opening gradually increased until, after a few days, everything passed through that channel, and ceased to make its appearance at the anal aperture. The patient, when three weeks old, was admitted to the Presbyterian Hospital April 15, 1898. It was then noticed that it was small for its age and poorly nourished; there was protruding from the umbilicus an ovoid maroon-colored mass, about the size and shape of a large hen's egg, and

directed obliquely towards the right; on the surface could be seen the reduplications of the *valvulæ conniventes*, the peristaltic movements were plainly visible, and the surface was moistened by the normal secretion of the glandular *mucosæ*; at its apex was an opening that evidently communicated with the lumen of the gut, and its base communicated with the umbilical aperture through the medium of a column of the same structure. About one inch in length, close to the base of this larger mass, and communicating with it, was a much smaller one directed obliquely downward and to the left; it was about the size and shape of

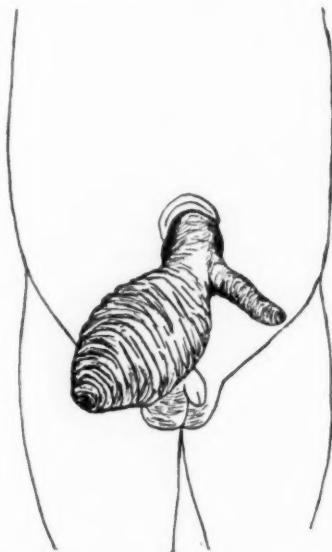


FIG. 1.—Appearance of parts before first operation, April 15.

the adult little finger; at its apex was also an aperture communicating with the lumen of the gut; the color of this protrusion was much lighter than that of the larger mass. (See Fig. 1.)

A few whiffs of chloroform were sufficient to make the child insensitive to pain, when an incision one inch and a half long was made through the abdominal wall in the median line and immediately below the umbilicus; this permitted the escape of several coils of small intestine, some dilated and moderately congested, others pale and contracted. These were traced to their entrance into the prolapse, but it was necessary to dilate the neck

of this by a slight incision, when the whole was easily reduced into the abdominal cavity. It was then easily seen that the prolapse was formed out of the ileum, projected through a diverticle arising from that gut at a distance of about one foot from its termination in the cæcum, the diverticle was about one inch in length and its mucosa was continuous with the integument of the abdominal wall. The proximal end of the gut, that nearest the stomach, was very much dilated, and the distal end, that nearest the large intestine, was very much contracted, so much so that it was thought doubtful whether it was prepared to carry

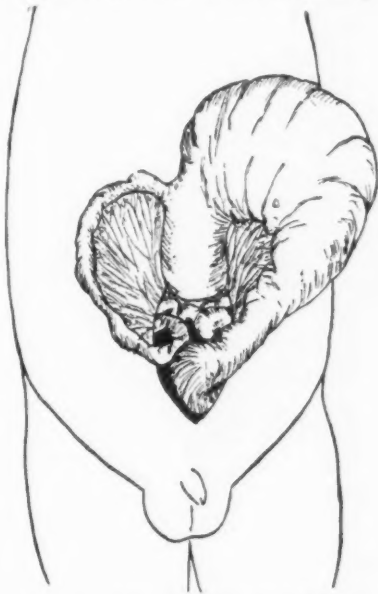


FIG. 2.—After reduction of prolapse.

on the intestinal contents to their destination. With the apprehension that if excision of the diverticle were made or an end to side anastomosis between the dilated portion of the small intestine and the colon, which latter operation would have occupied too much time for an operation on so young a child, it was deemed best for the present to be satisfied with reduction of the prolapse and the maintenance for a time of the "anus preternaturalis." This measure was accordingly carried out. (Fig. 2.)

The procedure was followed by very little shock. The patient was bottle-fed on equal parts of milk and barley-water, two

ounces every two hours. During the first ten days all fæces passed through the artificial opening, when an attempt was made to ascertain whether the collapsed intestine below the diverticle could be made to carry the fæces through to the colon. This was done by sealing the umbilicus with a pad maintained in position by adhesive straps. This demonstrated the fact that that portion of intestine was able to perform its functions without disturbance, all the alimentary contents passing through the normal channel. This condition was maintained until the 25th

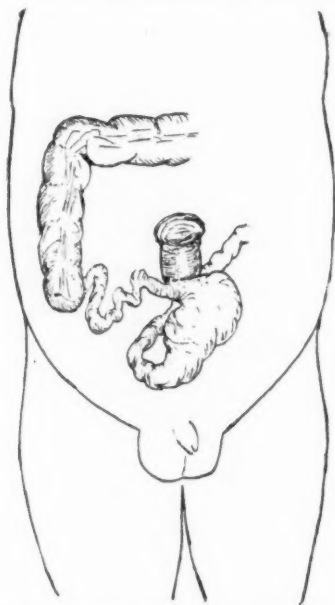


FIG. 3.—Representing operation of May 11; dotted lines show the line of section through diverticle.

of May, when a secondary operation was done, the object of which was to excise the diverticle and close its communication with the intestine. A very small amount of chloroform was administered, an elliptical incision, beginning three-quarters of an inch above and terminating the same distance below, enclosed the artificial anus. This was carefully deepened until the abdominal cavity was opened above; the round ligament of the liver was encountered below the urachus. Not being sure that these structures were obliterated, they were ligatured before divi-

sion; when the diverticle was severed from its attachment to the abdominal wall, it was drawn outside with the communicating coils of the ileum, a clamp was placed on it close to its junction with the latter, and it was excised. The opening in the gut was closed by two rows of suture, one continuous, passing through all the constituents of the wall, the second, a Lembert, continuous through the serosa. The gut was then returned to the abdominal cavity, the opening in which was closed with interrupted catgut sutures. (Fig. 3.)

Little or no shock followed this second operation. The child took its nourishment as before, and the dejections were normal and regular in character. The abdominal wound healed *per primam*, and now the child, though a very small one, has all the appearances of a healthy being. For the pen and ink drawings illustrating the parts before and during the two operations, he was indebted to Dr. Forbes Hawkes, the registrar of the hospital.

#### COLLES'S FRACTURE, WITH FRACTURE OF THE STYLOID PROCESS OF THE ULNA.

DR. F. TILDEN BROWN presented a young woman, who, on December 25, 1897, fell, fracturing the left wrist. She was first seen by Dr. Brown on the following day, when the conditions presenting were characteristic of Colles's fracture, with a great deal of tumefaction of the soft parts. A radiograph plainly showed a fracture of the radius, and suggested a fracture of the styloid process of the ulna, but this was not certain. The fracture was reduced under primary anæsthesia, but, on account of the great tumefaction, it was impossible to make out whether the reduction was satisfactory or not. At the end of a week a second radiograph showed that the fractured ends of the radius were fairly well approximated. The next picture, taken five weeks later, was very strongly suggestive of a fracture of the styloid process of the ulna, and another picture, taken two weeks later, proved this beyond a doubt.

The fracture was put up in a palmar and dorsal splint, with pads over the opposing surfaces of the radius just above and below the seat of fracture, and massage after the fourth day. The functional result was very satisfactory, but a deformity was noticeable at the end of the ulna.

Dr. Brown said he had observed two other cases of Colles's fracture during the past six months, both associated with fracture of the styloid process of the ulna.

#### A CYST OF THE RIGHT VESICULA SEMINALIS; ASPIRATION BY RECTUM.

DR. ARTHUR L. FISK presented a man, thirty-five years of age, who, when sixteen years of age, had some difficulty in passing urine, with pain referred to the bladder. This passed away after some weeks.

In 1880 he contracted a venereal sore on the glans penis;

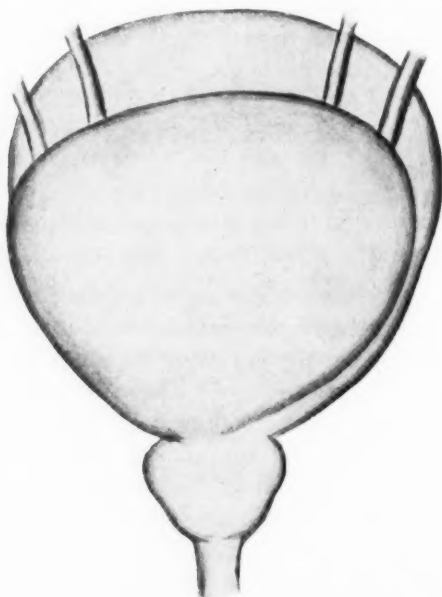


FIG. 1.—Showing the bladder in front of the tumor, which covers it posteriorly.

no secondary symptoms followed this. He denies ever having had gonorrhœa. In the autumn of 1894 he began to have soreness and pain in his right epididymis, which became so severe, finally, that he was compelled to quit his work. At the time, the last of November, 1894, he came to Dr. Fisk there was in the globus minor of the right epididymis a small nodule about one-half or three-quarters of an inch in size, which was thought

to be either tubercular or syphilitic, probably the latter, inasmuch as there was a slight general adenitis. In attempting to examine the vesiculæ seminales by the rectum, a large fluctuating tumor was, unexpectedly, discovered, which completely filled the lower portion of the pelvis, and extended upward beyond the reach of the finger. The bladder was in front of the tumor, which covered it completely posteriorly (Fig. 1). By bimanual palpation the tumor could be readily outlined; it was smooth, elastic, and gave a percussion wave. The prostate was small, but symmetrical. There was no difficulty in voiding the urine,

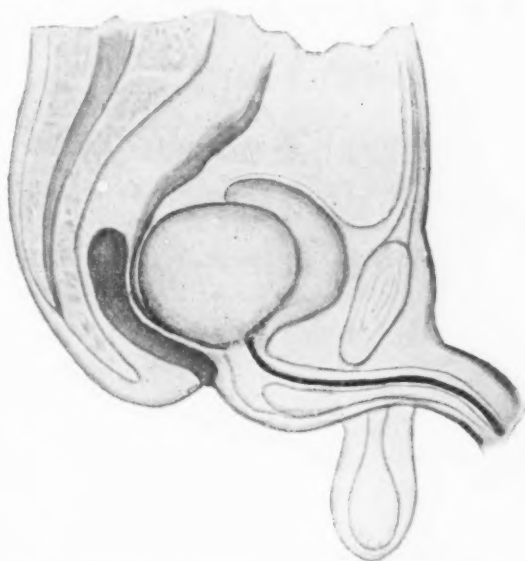


FIG. 2.—Position of tumor between the bladder and rectum.

which was at intervals of every three to four hours. There was no impotence, and seminal emissions occurred. Fig. 2 shows the position of the tumor between the bladder and rectum. The differential diagnosis was between a congenital cyst, a cyst of the seminal vesicles, a prostatic cyst, a tubercular abscess of the prostate, and a rapidly growing sarcoma. On April 21, 1895, the tumor was aspirated through the rectum, and sixteen ounces of a dark-brown fluid withdrawn, which was examined by Dr. Edward K. Dunham, whose report is: "A dark-colored fluid, sediment containing blood, leucocytes, compound granule cells,

cholesterin, and a little pus and fat. Reaction, alkaline; specific gravity, 1023; water, 91.06 per cent.; solids, 8.94 per cent.; ash, 0.65 per cent.; serum albumen, about 6 per cent.; serum globulin; lecithin; fat, small amount; cholesterin; no urinary constituents." The cyst, having partially refilled, was aspirated again on June 1, 1895, when four ounces of fluid, having the same characteristics, were withdrawn; on September 18 the cyst was aspirated for the third time, when two ounces were withdrawn. Since then it has not refilled, and the man is in excellent health.

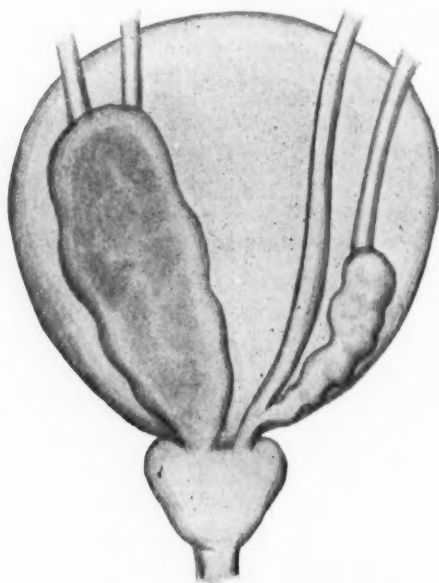


FIG. 3.—Illustrates the sac as felt by rectum.

All three aspirations were through the rectum and were without incident. Fig. 3 shows the sac as felt by rectum.

DR. ROBERT F. WEIR said that when he first saw the case, in consultation with Dr. Fisk, he was inclined to regard the cyst as associated with the remains of Müller's duct rather than with the prostate. Cysts connected with the seminal vesicles are not very rare, but those of the sinus pocularis are extremely so. The unilaterality of the condition in Dr. Fisk's case was a very interesting feature.



## BOTH BREASTS AMPUTATED FOR CARCINOMA.

DR. A. L. FISK presented a middle-aged woman, whose right breast, together with the axillary contents, was removed by Dr. Fisk in November, 1897, Halsted's operation being done. In the following April he found it necessary to remove the remaining breast for a similar condition. Primary union was obtained throughout.

DR. WEIR attributed the involvement of both breasts to the crossed condition of the lymphatics. In malignant disease of the tongue, for example, the involvement of one side demands careful examination of the glands on both sides of the neck.

DR. C. K. BRIDDON said that about a year ago he had removed the breast of a woman for carcinoma, the disease having resulted from a blow. About three months ago she had received a blow on the opposite breast, and a cancerous nodule developed.

DR. B. F. CURTIS said that in 1889 a woman came to St. Luke's Hospital with a carcinoma of the breast. The breast was removed, together with the axillary contents. A year later there was a recurrence in the scar, and at the second operation the scar, together with the entire pectoralis muscle on that side, was cut away. A year after that there was another carcinoma in the opposite breast, and this was removed by a radical operation, including the muscle. Some years later the patient complained of symptoms which were supposed to be cardiac. She died seven years after the first operation, and four years after the last operation, from carcinoma of the anterior mediastinum, presenting externally, without local recurrence on either side.

The case was interesting, Dr. Curtis said, as illustrating the possibility of a crossed infection, and also the slow course of the malignant process in the mediastinum.

## CARCINOMA OF THE MALE BREAST.

DR. F. W. MURRAY presented a man, fifty years of age, a stone-cutter by occupation, who first noticed about four years ago a small, hard nodule in the lower outer quadrant of the right breast. It grew slowly and without pain, until six months ago, when he applied poultices to draw it out. The skin broke down and ulcerated, the mass became painful, and it now commenced to interfere with his work. The axillary glands were markedly involved, and a number of cancerous nodules existed in the skin

of the right side of chest. Dr. Murray said he might attempt to remove the growth and the pectoral muscles and then skin-graft the wound. Owing to the evident extensive involvement of the skin, it might be found that the disease was too far advanced to expect relief from operation. This case was presented by Dr. Murray because carcinoma of the breast in the male is very unusual.

[Later and complete examination showed that the disease was too extensive for removal.]

#### PLASTIC OPERATION FOR CONTRACTURE OF THE JAW.

DR. ROBERT F. WEIR presented a man, thirty-seven years old, who in early infancy had sustained a fracture of the lower jaw followed by a contracture, which was so marked that he was only able to separate his jaws for a distance of one-quarter of an inch. For the relief of this condition, the patient had undergone nine operations, including repeated division of the contracted tissues, and resection of a portion of the jaw-bone, according to Esmarch's suggestion, but all proved unavailing.

About a year ago the patient came under Dr. Weir's observation at the New York Hospital, and the following operation was done: All the cicatricial tissue on the inside of the mouth was cut away, leaving only the skin; a long, narrow strip of skin was then removed from the neck, and inserted through a vertical cut just anterior to the masseter muscle, tucked in and sutured, thus furnishing a non-contracting flap for the inside of the cheek.

Dr. Weir said that seven months had elapsed since the operation, and the result thus far was excellent, as the patient could now open his mouth for an inch and a half, whereas previous to the operation he could only open it for a distance of one-quarter of an inch.

#### POSTERIOR THORACOTOMY FOR FOREIGN BODY IN THE RIGHT BRONCHUS.

DR. B. FARQUHAR CURTIS read a paper with the above title, for which see page 605.

DR. J. D. RUSHMORE reported a similar case, which had come under his observation some years ago. The patient was a man who had accidentally inhaled a small cork, which became firmly lodged in the left bronchus, and was followed by collapse

of the corresponding lung. A low tracheotomy was done, through which an unsuccessful attempt to remove it was made. The mucous membrane on the proximal side of the cork became very much swollen, and formed an insurmountable obstacle to the introduction of any loop of wire for the purpose of removing the cork. The patient died from a septic pneumonia.

Dr. Rushmore said he had performed anterior thoracotomy on the cadaver, and he agreed with Dr. Curtis regarding the difficulties of that procedure. It is impossible to determine before operating whether there are pleural adhesions, and even in their absence, the space is so small that it is difficult to work in,—the difficulty being vastly increased in the live subject by the movements of respiration and the constant filling and emptying of the enormous vessels in that region. It was also a matter of very great interest that by digital examination through a tracheal wound one can explore the entire length of the trachea down to the bifurcation.

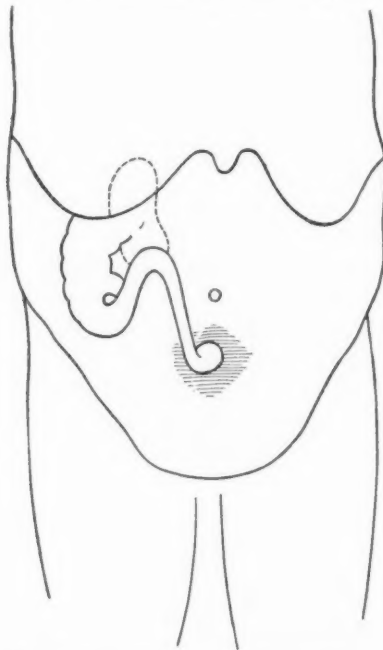
Dr. WEIR said he had rehearsed the operation of posterior thoracotomy on the cadaver, which, however, gave one a very inadequate idea of the difficulties of the procedure on the living subject. The speaker referred to a case coming under his observation, where the patient inhaled a silver half-dime piece, which gave rise to a severe bronchitis. Twenty-five years later the coin was coughed up spontaneously, and the bronchitis disappeared. In another case, during an operation for necrosis of the jaw, one of the patient's teeth entered the larynx and became obstructed in the left bronchus. The patient refused to submit to an operation for the removal of the tooth, and death occurred from septic pneumonia. An interesting point in connection with the case was that the patient had taken the anæsthetic very badly and had struggled violently during the operation. Investigation afterwards showed that he had been anæsthetized with sweet spirits of nitre.

In another case, reported by Dr. Weir, the patient was a young girl, who inhaled a tooth after its extraction by the dentist. When Dr. Weir saw her, on the following day, the left bronchus was found to be blocked. He opened the trachea low down and finally succeeded in removing the tooth by means of a wire, to which were attached a number of small loops of thread, which caught in the irregularities of the tooth. The patient made a good recovery.

DR. A. G. GERSTER reported the case of a girl, about eight years old, who inhaled a bean. A low tracheotomy was done, and through this opening various instruments were introduced for the purpose of catching the foreign body, which was so smooth and slippery that it was impossible to grasp it. During the frequent fits of coughing the bean would come up as far as the incision in the trachea, only to be drawn down again with the next inspiration. Finally, a soft rubber drainage-tube was pushed down into the trachea, and by suction with the mouth the bean was drawn into the tube and successfully removed. The child made a good recovery.

A CONICAL CÆCUM WITH A LONG APPENDIX  
SIMULATING A URETER.

DR. WEIR showed a cæcum terminating in a long appendix,



Weir's case of long appendix with conical cæcum ;  
dotted lines represent the kidney.

which he had removed from a patient upon whom he had operated for appendicitis. There was an abscess situated just to the

left of the median line, which was associated with an appendix nearly one inch in diameter and with a bulb-like termination, which represented old inflammatory deposits. The appendix was seven inches long; it terminated in a rare form of elongated conical cæcum, and at first extended upward towards the kidney; in this respect, as well as by its gradual enlargement, it simulated a ureter running into the renal pelvis, and at first caused some embarrassment, as it was for a few moments difficult to tell whether or not it was behind the peritoneum. Further tracing showed a sharp turn to the right, across the lower edge of the kidney, and, finally, its insertion into the cæcum, which was situated well above the crest of the ileum. The accompanying rough sketch shows fairly well the course of the appendix.

## TRANSACTIONS OF THE PHILADELPHIA ACADEMY OF SURGERY.

*Stated Meeting, June 6, 1898.*

The President, J. EWING MEARS, M.D., in the Chair.

### CHOLECYSTOLITHOTOMY.

DR. ROBERT G. LE CONTE reported the following case: A man, fifty-eight years of age, enjoyed fair health until June, 1896, when he suffered a severe attack of hepatic colic, followed by others at short intervals. During the fourth attack he was admitted to the Methodist Episcopal Hospital, under the care of Dr. Tunis. The tumor rapidly subsided and the symptoms abated. He was placed on a tonic treatment with large doses of olive oil, and the stools carefully watched for calculi, but none were passed. The bowel movements did contain frequently a quantity of sandy material, which, on examination, proved to be mostly cholesterin. He remained in the hospital eight weeks, gained fifteen pounds, and felt perfectly well. He continued well for several months, when his attacks recurred in a milder form, with considerable intestinal indigestion and fermentation. In only one of these attacks (September, 1897) was the gall-bladder again enlarged. The attacks subsided with a considerable quantity of this sandy material in the stools. He was readmitted to the Methodist Episcopal Hospital April 12, 1898, under Dr. Le Conte's care, just after one of these attacks. He was very thin, weak, and slightly jaundiced. Examination of the abdomen revealed an enlarged liver, extending an inch or more below the border of the ribs, a little harder than normal, with a rounded edge. The gall-bladder could not be detected. The other organs were apparently normal, except that the lungs were slightly hyperresonant. He was placed on a light, nutritious diet, principally milk, eggs, and rare meats, the bowels kept open with phosphate of soda and Hunyadi water, and nitro-muriatic acid administered.

At the end of two weeks he had gained five or six pounds, and felt quite strong again. He was told that his attacks probably depended upon gall-stones impacted in the gall-bladder, although their demonstration was impossible. He consented to operation. Etherized April 27: abdomen opened over region of gall-bladder for a distance of three inches and a half. The transverse colon was adherent to and covered the whole gall-bladder. On separating the adhesions a contracted, small, dense gall-bladder was exposed, adherent through its whole length to the liver, with the fundus about an inch from the anterior edge of the liver. Calculi could be easily felt through its walls. It was immovable and impossible to bring to the surface of the wound. The surrounding bowel was packed off with gauze, a silk stitch passed through the fundus for better control of the organ and its under surface incised for an inch. The walls were nearly a quarter of an inch thick. Six stones were removed, the last being well down in the cystic duct. In addition to the stones, it contained a drachm or two of turbid, mucous-like fluid. The common and hepatic ducts were free from concretions. The gall-bladder wound was then closed with a continuous silk suture, penetrating to the mucous coat, but the attempt to cover this with a running Lembert suture failed, owing to the unyielding rigidity of the walls. A strip of gauze was then packed around the gall-bladder, and the abdomen closed with through-and-through silkworm-gut sutures. No reaction followed the operation. The gauze pack was removed in forty-eight hours, and a small rubber tube inserted for a day. The wound was entirely healed in ten days, and the recovery uneventful.

UNSUCCESSFUL NEPHROLITHOTOMY, WITH SUBSEQUENT PASSAGE OF THE STONE  
BY URETHRA.

DR. LE CONTE also reported the following case: E. E. S., aged twenty-six years, printer, was admitted to the medical wards of the Methodist Episcopal Hospital February 11, 1897, with symptoms of gastro-enteritis, fever, headache, coated tongue, anorexia, vomiting, constipation, and abdominal pain and tenderness, more marked on right side. These symptoms began suddenly, and were of four days' duration, and gradually subsided three or four days after admission.

*Previous History.*—Perfectly well until three and a half years ago, when he was suddenly seized with throbbing pain in right lumbar region, lasting two days. Since then similar attacks have recurred every two to four weeks, and latterly the pain has extended to the bladder. The right kidney was high up and difficult to palpate, but no stone could be felt. The patient was advised that renal calculus was the probable cause of his trouble, but he refused to remain for operation. Readmitted to the hospital March 8, 1897, surgical wards, with a history of another similar attack since last admission. Urine twice examined. Phosphates and uric acid abundant, but no blood or pus present. Three radiographs were taken by Dr. Goodspeed, all of which proved negative. To recapitulate: The attacks were always sudden in onset, without apparent cause, with vomiting, pain, and tenderness most marked in the region of the right kidney, and referred to the bladder. Palpation only showed a high position of the kidney; urine without blood or pus, and the radiograph negative; diagnosis, renal calculus. Two days after admission the patient was etherized and a lateral lumbar incision made over the right kidney. Only the lower part of the organ was exposed, and after much difficulty, owing to fibrous bands, the whole kidney was brought down into the wound. Careful palpation of the organ did not show anything, and a needle passed in various directions met with no resistance. The kidney was not opened, and the diagnosis revised to perinephritic inflammation with adhesions. The kidney was returned free of adhesions, a strip of gauze and a small rubber drain inserted, and the wound closed. The recovery was uneventful, but delayed, owing to the drainage track persisting as a small sinus. Discharged April 7; wound entirely healed. About two weeks after his discharge he had another attack of renal colic, lasting about a day, and two days later he voided with the urine a small stone, seven-sixteenths of an inch long by one-fourth of an inch broad. The stone, at the time of operation, was probably caught in one of the calyces, and the manipulations which were practised on the kidney dislodged it, allowing it later to engage in the ureter and be passed. The kidney was not opened at the time of operation, because the operator believed he had been mistaken in his diagnosis, and that the adhesions found were probably sufficient to account for his symptoms.



DR. W. J. TAYLOR remarked that in all cases of kidney operations, whether the surgeon is able to feel the stone in the kidney by means of the needle or not, the kidney should be opened. In many cases the stone is not found by the needle when unquestionably there is a stone in the organ itself, and it does not materially increase the gravity of the operation, if at all, to incise the kidney. If no stone is found, a slight amount of drain can be kept up, which will relieve the congestion of the kidney, and he thought that the future value of a kidney is not materially decreased by such an operation.

DR. BARTON agreed with Dr. Taylor, as he had known of some cases where the stone undoubtedly would not have been found if the kidney had not been opened. He thought it also well to examine the pelvis of the kidney and the ureter. In one case, in which he not only exposed the kidney but incised it and failed to find the stone, the symptoms persisted, and some months after he decided to excise the kidney. After delivering the kidney, and before cutting and ligating the vessels, on running his finger down the ureter, he detected a large stone in a dilated ureter. He incised the ureter and delivered the stone, closing the ureter with a continuous Lembert suture, and, after ligating the bleeding points of the torn kidney, put it back again. The man made a perfect recovery.

DR. LE CONTE said, in rejoinder, that he agreed thoroughly with the remarks that had been made, but in this case the kidney was very difficult to get out. It was densely adherent, and he thought the local condition would probably account for all the symptoms. He did not care to open the kidney, as he could not reach the artery to compress it, and he was a little fearful of hæmorrhage. However, in a stone of this small size, he doubted very much if he would have been able to find it unless he had cut the kidney to a very great extent.

#### EXCISION OF THE HIP-JOINT.

DR. HARRY C. DEEVER presented a young man, who was admitted to the Episcopal Hospital July 25, 1896, with a history of having injured his hip by falling from a building twenty months previously. Sixteen months later an abscess developed, and was opened, and when admitted was draining through a sinus on the anterior surface of the thigh. He complained of

severe pain, especially on motion. There was no ankylosis, but dead bone could be felt at the bottom of the sinus, which led directly into the joint. Three days after his admittance an excision was made of the head by "Barker's" incision; a counter-opening was made and a drainage-tube was inserted. The case did well. At the end of three weeks gentle passive motion was made. The fourth week he was up on crutches, and was discharged seven weeks after operation. It is almost two years since operation, the wound is entirely healed, and he has good motion in the hip-joint.

DR. WHARTON said that he had had a few cases of anterior excision of the hip, and he thought it to be a very good operation in early cases, where an abscess has formed. You can then remove the dead bone and leave practically all the muscular attachments to the greater and lesser trochanters of the femur. The operation is not an easy one, particularly in adults. Even after dividing the neck of the bone close to the shaft, it is often very difficult to deliver the head of the bone. He had operated on a few young children in the early stages of hip-disease, and here it is a very favorable operation.

With reference to the amount of shortening, it is less than in the ordinary excision, where the head and neck and greater trochanter are removed.

#### SEPARATION OF THE LOWER EPIPHYSIS OF THE FEMUR.

DR. HARRY C. DEAVER presented a boy who was admitted to St. Mary's Hospital November 11, 1897, having had his left leg caught between the spokes of a revolving wheel of a wagon, and having sustained in consequence a fracture of the thigh through the lower epiphysis. Dr. Deaver saw him the following day, and found the limb greatly swollen at the seat of injury. The lower end of upper fragment could be felt in popliteal space. He opened up the popliteal space in the median line, and found liquid blood and clots and an oblique fracture, the line of fracture extending from without inward, beginning one inch above the epiphyseal line, going through the epiphysis, and extending down into the internal condyle of the femur, and communicating with the knee-joint. He delivered the lower end of the upper fragment, sawing about a half inch off of it, and reduced the

fracture. The wound was closed, with drainage, and the limb dressed in a flexed position at an angle of 135 degrees. Twelve days later the wound was dressed, and the limb straightened out, and put in plaster. Twenty-two days after this the plaster was removed, and passive motion and massage completed the cure. He has now very good use of the limb, with perfect flexion and extension.

DR. WHARTON remarked that this case could hardly be classed as a typical compound separation of the lower epiphysis of the femur. The manner in which it was produced seems to be one in which many such accidents occur. He had seen three compound separations of the lower epiphysis of the femur produced in the same manner; in all of these cases, by reason of the extensive injury to the soft parts and blood-vessels, amputation was required.

DR. HARTE thought that this case, which was not a true epiphyseal separation, but a fracture running obliquely downward to the epiphysis, would go to refute the popular idea that all injuries of the lower parts of the femur in children are epiphyseal separations. It has been stated by a very excellent authority that in all injuries, in relation to joints, the epiphysis being the weaker point, the bone was invariably separated at that point. This case illustrates the opposite view, and you would naturally suppose that in an injury of this sort the femur would give way at the epiphyseal juncture, as it was presumably the weaker point, but in this case the reverse had happened.

#### POSTCÆCAL ABSCESS OF APPENDICULAR ORIGIN.

DR. HARRY C. DEAVER said that on the 16th of May, 1897, he was called by Dr. Keith, of Schaefferstown, Lebanon County, Pa., to see a young man, aged twenty-two years, who was suffering with a very severe attack of appendicitis. One week previously, while in a five-mile bicycle race, he was taken with a severe pain in his abdomen, which gradually got worse, but being anxious to win the trophy, he rode to the finish. The doctor saw him a few hours afterwards, when he found him suffering with general abdominal pain, vomiting, and extreme tenderness all over the abdomen. The pain was relieved only by large doses of opium (*tinctura opii deodorata*). When Dr. Deaver saw him

he was in a semi-narcotized state, pupils contracted, pulse 130, weak, and compressible; temperature 99° F., an anxious expression, rigidity of abdominal wall on both sides, but more tenderness on the right side. He had had practically no nourishment since his attack. Dr. Deaver declined to operate, on account of the general peritonitis, his extreme weakness, and seminarcosis, but recommended to withdraw the opium, to encourage bowel movements by enema and calomel by the mouth, agreeing to operate later if he improved. His condition did gradually improve, and two weeks later Dr. Deaver saw him the second time, and found his condition to be very much better; pulse 90, fair volume; temperature 99½°. The general abdominal tenderness and rigidity had subsided, but there was a tender spot over the region of the appendix, with slight fulness, but no fluctuation. He made an incision over this area, and opened up a small abscess cavity, which contained about an ounce and a half of pus, which was not very offensive. He examined the cavity very carefully, feeling that there must be a larger collection of pus elsewhere, as an abscess cavity of this character did not account for the severe character of his illness, but could not find any communication, so he simply packed with iodoform gauze. The patient was under ether twenty minutes; he was considerably shocked. Stimulants were given freely, strychnine hypodermically. One hour after this he began to hiccough, which rapidly grew worse, and continued for twenty-four hours without relief, when he was seized with a violent fit of coughing, which was followed by free expectoration of dirty, foul pus, faecal in odor. His general condition was very bad, the flow of foul pus through bronchi continued for a week, then gradually subsided, and the patient began to improve, and rapidly convalesced, and was out of bed in one month's time from the operation. In the opinion of the reporter the abscess cavity that was opened was secondary to the collection behind the cæcum and colon, and the appendix was postcolic. When the appendix holds this position it is usually adherent to the colon without any mesoappendix, unless it is at its distal end, where it is sometimes found free with a short mesentery. He had seen this condition in cases in which he had operated for chronic appendicitis. When the end of a postcolic appendix lies high up the extreme point of tenderness may be in the region of the right kidney, and the symptoms may

simulate a perirenal suppuration, or if the base of the appendix be the seat of perforation, the point of greatest tenderness may be in the loin, just above the post-superspinous process. In the case reported this postcolic abscess burrowed and extended along the under surface of the diaphragm, ulcerating through into the right lung, and rupturing into a bronchus. The retching caused by the anæsthetic excited violent contraction of the diaphragm, and subsequent rupture of the abscess cavity. At no time during this young man's illness did he present any symptoms of such a condition.

A second case of postcæcal abscess was as follows: A young man, aged twenty-six years, had been ill two weeks with acute appendicitis; the onset was sudden and severe. He had general peritonitis. Treatment had been "opium and salts." When first seen by Dr. Deaver his temperature was 99° F., pulse 80, with localized soreness over appendical region, some rigidity of right rectus with a decided swelling. His general condition was good, stomach retentive, bowels moving daily, and he was taking sufficient liquid nourishment. He was brought to Philadelphia the following morning, and operated upon at 4 P.M. A large abscess was opened, thoroughly cleaned, and carefully examined, but found completely shut off. He did well for thirty-six hours, when peritonitis set in, which was thought to be the result of leakage from a deeper seated abscess. The abdomen was reopened, and a large abscess cavity was found behind the cæcum, which had dissected up the inner layer of the ascending mesocolon, and extended under the mesentery. The peritoneal cavity was thoroughly washed out and drained. Patient did not react.

In dealing with appendical abscess, Dr. Deaver had found that they vary according to the position of the appendix. When the appendix comes off the lower end of the cæcum, and lies to the outer side, in relation with the iliac fossa, an abscess in this region is easily dealt with. The pus cavity is either opened up as soon as the peritoneum is incised, or the omentum covers the abscess, congested with a small area of inflammatory induration, which locates the abscess with a gangrenous or perforated appendix. When the appendix comes off the base of the cæcum and extends into the pelvis, the location of the abscess depends on the seat of perforation. If it is at the base of the appendix, it will be found underneath the cæcum, and frequently he had

found a secondary abscess in the pelvis communicating with it. When that portion of the appendix occupying the pelvis is gangrenous at perforation, we find the abscess in this region, and if it is of long duration, it may extend as far as the rectum or bladder, and rupture into one of these viscera. A postcæcal appendical abscess may burrow behind the ascending colon, rupturing as it did in the first case reported, may extend under the inner layer of the ascending mesocolon and under the mesentery, as it did in the second case. These two cases demonstrate the importance of early operation in acute appendicitis.

#### THE TREATMENT OF FRACTURES OF THE NOSE.

DR. G. G. DAVIS read a paper with the above title, for which see page 458.

DR. HARTE remarked that there is no bone that recovers so quickly after an injury as the nasal bones, and if not properly replaced at once evil results are certain. In fractures of the nose this point is often overlooked. He thought that in nine cases out of ten of fractures of the bridge of the nose—except of the extreme tip—there is a fracture of the vertical plate of the ethmoid.

His method in dealing with these cases was to use the Adams forceps, carried well in, to forcibly raise up the arch of the nose, then properly replacing the parts with the fingers. Sometimes it may be necessary to plug the nose. Plugging both sides of the nose is a mistake. By plugging one side lateral deflection is more easily corrected. He had never had very much success with the use of catheters, tubes, etc., in the nose.

The great thing in dealing with fractures of the nose is perfect reduction, and that can only be obtained by proper elevation of the fragments by the use of the Adams forceps.

## EDITORIAL ARTICLE.

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### REHN ON THE SUTURING OF PENETRATING WOUNDS OF THE HEART.<sup>1</sup>

THE author has made a study of this subject after an experience with such a case in his own practice. The elaborate studies of the pathological anatomy of the heart made by His, Krehl, and Romberg have shown that it is not the cardiac ganglia which are the motor centres of the heart's action, but that the cardiac muscles themselves are the automatic and regulating motor, while the sympathetic ganglia are purely of a sensory character.

Prompted by his successful case of heart suturing, Rehn had his assistant, Bode, make a number of experiments upon rabbits in Landois's physiological institute at Greifswald, with the following results:

Slight local disturbing of the heart was without influence upon the heart's action; stronger pressure caused temporary arrhythmia; touching the heart muscle caused nothing more than a momentary stopping of the heart, followed by a slowing and arrhythmia. Small wounds gape but slightly; larger wounds always gape, the degree of gaping depending upon the relation of the wound to the direction of the muscle fibres. The primary bleeding is systolic in character, and most marked from wounds of the auricles, being always fatal in animals. Medium-sized wounds of the right ventricle bleed more freely than those of the left. In small wounds the hæmorrhage ceases spontaneously after a time. The author attributes this not so much to coagulation, but more to a power of accommodation of the muscle.

<sup>1</sup> L. Rehn, Verhandlungen der Deutschen Gesellschaft für Chirurgie, XXVI Kongress, 1897.



The question of heart-suture has been studied also by the Italian surgeons, Vecchio and Solomoni, who have successfully sutured perforating wounds in the hearts of dogs. Farino sutured a wound of the left ventricle in a patient of his, who died of some intercurrent disease.

The first effect of a penetrating heart wound is shock, which is the result of diminution of the blood-pressure causing incomplete filling of the arteries and venous stasis. This causes an anæmia of the central nervous organs, and perhaps a disturbance of the nourishment of the heart muscles themselves. Sudden collapse, weakness, cyanosis, air-hunger, and a poor, irregular, and rapid pulse are the symptoms of these lesions. Then follows the period of accommodation, in which the hæmorrhage ceases.

The dangerous secondary hæmorrhage, which has been observed in nearly all cases, Rehn has found in his observations to be diastolic in character. The further factors which disturb the circulation and the heart's action are the tense filling with blood of the pericardial sac, and the associated wound of the pleura or lung, which often exists. In most wounds of the heart the pleura is opened.

The following points may be designated as guides in the diagnosis of wound of the heart: (1) Shock; (2) the position of the external wound; (3) the form of the instrument causing the wound; (4) probing the wound canal to discover its direction, which Rehn claims is allowable if very carefully done; (5) the presence of pulsation in the outer wound, which, in many cases, is of the greatest importance; (6) the symptoms of hæmopericardium; (7) and, finally, hæmothorax.

Even when not all of these signs are present one may be sure of the diagnosis; but in all doubtful cases the possibility of wound of the heart should not be lost sight of.

The question of therapy is a difficult one, and has consisted chiefly in perfect quiet, cold applications, and, finally, injections of camphor. The long-recognized hæmostatic value of vene-



section is not recognized by Rehn in these cases. He regards the value of this practice as doubtful at best.

Concerning closure of a heart-wound, Rose has recommended incision of the pericardium to give better access to the wound. With regard to this point, Rehn has taken exception to the statements in most text-books concerning the position of the pericardium when distended. These exceptions are based upon numerous observations which he has made upon animals. He finds that in hæmopericardia the heart is not dislocated backward by the pressure of the fluid, but lies in quite close relation to the chest wall. Riedel has also made this same observation. For this reason he claims that therapeutic puncture of the pericardium is a more dangerous operation than is generally assumed, and he recommends the exposure of the pericardium, and then the very oblique introduction of the needle, followed by drainage, for the complete emptying of the sac. In cases of coagulation of blood in the pericardium and a cessation of hæmorrhage, he arrives at the following conclusions for the operative technique of exposing the heart and suturing the same. The temporary resection of the fifth and eventually of the fourth left ribs, near the mammary line, and turning the flap back upon the sterno-costal joints, exposes the anterior wall of the right and a large part of the left ventricles. By resection of the third and fourth right ribs and a part of the sternum, and turning back the flap, the right auricle is exposed. The separating of the pericardium from the pleura can be accomplished with little difficulty. He recommends free opening in case of hæmothorax, and in hæmopericardium this is necessary to prevent the formation of bloody froth. The suturing of the wound in the heart can be greatly facilitated by drawing upon the pericardium, whereby the heart is brought more anteriorly. The right ventricle must be sutured during diastole, and the left during systole. By temporarily fixing the heart by means of the first suture the continuation of the operation is facilitated.

The following case illustrates the above statements:

A man, twenty-two years of age, sustained on the 7th of September, 1896, a penetrating wound in the left breast, causing unconsciousness and collapse. After continued faintness he was brought to the hospital, his clothing covered with blood, and the patient himself in a state of collapse, deathly pale, and gasping for breath. Examination showed a wound one and five-tenths centimetres broad in the fourth intercostal space, on the left side, which was not bleeding. There seemed to be an increase of heart-dulness towards the right side.

Notwithstanding stimulation of every sort, the condition of the patient grew worse from hour to hour. Dulness extended to the left pleural cavity, and dyspnoea increased. Respiration became 76 per minute; as the cardiac dulness increased the pulse became poorer, and the necessity of operative interference became imperative.

After temporary resection of the fifth left rib, near the mammary line, and emptying the copious collection of blood from the thorax, a small opening was discovered in the pericardium. Through this opening venous blood was found to be escaping. The clamp which was applied pulled out. Free incision was then made, and the pericardium lifted up by clamps applied at the wound. This brought the heart up into full view. Its action could be seen perfectly. The diastole seemed to last longer than the systole. A wound one and five-tenths centimetres long, which was bleeding freely, was discovered in the middle of the right ventricle. This wound was closed by three interrupted silk sutures, and the bleeding immediately stopped.

It was especially to be observed that the finger could be pressed upon the wound to stop the bleeding without interfering, to any considerable degree, with the action of the heart; but the introduction of the needle and the drawing up of the suture each time caused a momentary stopping of the heart's action. The extraordinarily wide excursions of the heart were noticeable. Be-

sides the usual rotation upon its long axis there was a sidewise motion from left to right, so that the right ventricle completely disappeared under the sternum during systole, and the left ventricle came into full view. According to Rehn's view, so wide an excursion of the heart is only possible in such an abnormally distended pericardial sac.

The healing in this case was complicated by pneumothorax and a long-continued suppuration. The patient eventually made a complete recovery.

JAMES P. WARBASSE.

## REVIEWS OF BOOKS.

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MANUAL OF OPERATIVE SURGERY. By H. J. WARING, M.S., B.Sc., F.R.C.S. Edinburgh and London: Young J. Pentland; New York: The Macmillan Company, 1898.

ATLAS AND EPITOME OF OPERATIVE SURGERY. By DR. OTTO ZUCKERKANDL, Privat-Docent in the University of Vienna. Authorized translation from the German. Edited by J. Chalmers Da Costa, M.D. Philadelphia: W. B. Saunders, 1898.

These books are intended to give the student an idea of the technique of the various operations in surgery. They are used to supplement the studies of operative surgery upon the cadaver; but may be turned to more practical account by the general practitioner, who would refreshen his memory, when about to perform an operation. They both well fulfil the purpose for which they are intended.

The English work takes up the various operations, and under each one gives the indications for its performance, the selection of instruments, the position of the patient, operator, and assistants, the technique of the operation, and the after-treatment. The preliminary preparation of the patient for anæsthesia and for asepsis is also considered. In the preparation for anæsthesia the author says that no food should be given by mouth for three or four hours before the operation. A patient who eats a meal three or four hours before operation, we believe, will, in a large proportion of cases, still have undigested food in the stomach at the time of anæsthetization. "Proper observance of these precautions," the author says, "tends to avoid vomiting." The author, we presume, means "tends to prevent vomiting."

Mr. Waring makes the median abdominal incision through the linea alba, because, he says, the risk of the occurrence of ventral hernia at a later period is minimized by such an incision, whereas, for several years past, many surgeons have avoided the linea alba, and made their opening into the abdomen, through the muscle, just to one side of the white line for this very reason. In the description of the operation of suprapubic cystotomy, distention of the bladder with air is not mentioned. The obsolete method of extraperitoneal treatment of the stump in abdominal hysterectomy is described. We infer that the author of the description of vaginal hysterectomy does not frequently perform the operation. With the patient in the dorsal position, he first makes the upper incision; and then, with the blood running down over his field of operation, incises the posterior fornix. In describing the operation for strangulated inguinal hernia, it is advised to cut the ring, then, if the intestine is found to be non-gangrenous, it is gently manipulated back into the abdominal cavity. Then immediately follows this terrible advice, "It should be drawn downward, unravelled, and then transfixed in several places, tied in sections, and the distal portion removed." This sounds as though it were meant for the omentum, but nothing of the omentum appears in the context.

In brief, we may say that the operations are usually clearly and well described. The illustrations are fair. The book is well printed and well bound.

The work of Dr. Zuckerkandl is upon much the same lines as the English work. The translation is well done. One of its most attractive features are the illustrations. It contains 217 cuts and twenty-four colored plates. These plates are models of beauty and accuracy, and add greatly to the value of the book. The illustrations, as a whole, are very superior to those in the other work. The trocar and cannula represented for suprapubic aspiration are unnecessarily big for that purpose. The illustration of the suprapubic cystotomy wound is defective in that the wound is made to involve the pubic hair. The operations are

well described. This is a particularly good book, and, like the English work, will be found an excellent guide in instructing in operative surgery.

JAMES P. WARBASSE.

A MANUAL OF MODERN SURGERY, General and Operative. By JOHN CHALMERS DA COSTA, M.D. Philadelphia: W. B. Saunders, 1898.

This is the second edition of this work, the first of which appeared four years ago. The author states in his preface that the aim of the work has been to present in clear terms and in concise form the fundamental principles, the chief operations, and the accepted methods of modern surgery. The author's aim has also been to exclude obsolete and unessential methods, and to make no attempt to exploit unprovable hypotheses or to champion fanciful theories. However well he may have succeeded in these high aims, his earnestness of purpose is most commendable.

The work opens with a brief chapter upon bacteriology. The chapter on inflammations is characterized by the comparatively large amount of space devoted to the therapeutics of inflammation. The student of surgery will get a very erroneous impression of the importance of constitutional measures in the treatment of this class of cases. The fever which follows wounds or operations, the author designates as traumatic fevers; and these he divides into two classes, benign and malignant. The paragraph on the treatment of œdema opens with the recommendation that œdema be relieved by multiple punctures: compression is referred to later. The author is convinced of certain dangers in using hydrogen peroxide, for in two places in the book he relates the same instance of how a child narrowly escaped death from this agent.

The prophylactic treatment recommended for tetanus is radical. "Every punctured wound is to be incised to its depth

and thoroughly cleaned and drained." This will keep us busy preventing tetanus.

In speaking of the closure of wounds of mucous membranes, the suture material given first place is silver wire. "A mole ought to be excised, because, if allowed to remain, it may become malignant," the author says; and thus the surgeon is exhorted to keep on the move. Jarvis Wight will find his method of treating carcinoma credited to one Wright.

There is one particular sentence in the work which smacks of the old-time courtesy, which it is refreshing to encounter in these days of cold statements. It is a foot-note, and reads as follows: "See the exceedingly clear and terse account in that excellent book, 'A Manual of Surgical Operations,' by Joseph Bell."

Fractures are treated in the good old fashioned way, much as Joseph Bell treated them. We know of no recent work on surgery in which the dear old relics, the fracture-box and lead-water and laudanum, are so much in evidence. In the treatment of fractures of the bones of the leg, the author says, "If the fracture is compound, aseptinize thoroughly, make a counter-opening, insert a drainage-tube," etc. It is very wrong, we believe, for a teacher to lay down such a rule for the treatment of compound fractures, a large proportion of which are very simple affairs, and require no such radical measures. In connection with this the reader is referred to Fig. 70, the like of which we hope never to see, and from all of which the learner will get a mistaken notion of the real surgical treatment of compound fractures of the leg.

In the treatment of prepatellar bursitis, the author advises incision and packing the sac with gauze, but does not mention excision of the sac. Under the subject of local anæsthetics he says, never use more than one-third of a grain of cocaine hypodermically!

It is recommended to give antipyrin in appendicitis for the purpose of relieving the pain; but opium is advised against be-

cause it masks the symptoms. From this we infer that the author gives his antipyrin along with a prayer that it will not reduce the temperature or relieve the pain. The book contains many inconsistencies. Often the teaching is positively erroneous. Certainly, the great bulk of surgical teaching is based upon certain generally accepted principles which make up the larger part of any work on general surgery. In this book, these are presented in due and ancient form: it is principally in the mooted questions that confusion arises. The chapter on ulcers is particularly good, and the subject of empyema is well handled.

NEWTON JAMES.

TRAITÉ DES MALADIES CHIRURGICALES D'ORIGINE CONGÉNITALE. By E. KIRMISSON, Associate Professor of Surgery, University of Paris. With 312 figures in the text, and two colored plates. 8vo, pp. 768. Paris: Masson & Co, 1898.

A large number of deformities may exist in the child at the time of birth,—club-foot, harelip, spina bifida, and many others. Months or even years later other conditions may develop, which, although not appearing at the time of birth, are properly to be classed with congenital disease. Certain forms of inguinal hernia, due to the non-closure of the peritoneal canal, are truly congenital herniæ, although years may elapse before the hernial tumor makes its appearance. The burial deep within the body of a fragment of epithelial matrix during intrauterine life may give no sign of disturbance till the time of puberty, when all tissue change is accelerated, and from the harmless fragment a dermoid cyst may rapidly develop. Other similar facts could easily be cited, but enough has been said to show the wish of the author, in choosing his title, to include all surgical diseases of congenital origin, and not merely those which are congenital in the common acceptance of the term.

As the babe develops to the child and then reaches maturity, the separation of diseases as to their congenital or acquired



origin becomes more and more difficult. Many questions have of necessity arisen in this connection which are even yet unanswered or are the subject of controversy. Only by careful embryological study can we hope to clear away these clouds of uncertainty, and that Dr. Kirmisson is a firm believer in this method of investigation is declared in the preface, and shown in every chapter of the work.

The author is surgeon to one of the large Parisian hospitals, where the pædiatric service is of principal importance. Here for eight years he has made a careful study of the congenital diseases of the children under his care, and his observations and conclusions are embodied in the present volume, leaving those defects and diseases of acquired origin for a subsequent effort. No claim is made that the treatise is an exhaustive one; in fact, in the preface he frankly states that with many abnormalities he has had no experience, and in others the cases observed have been very few, but it has seemed better to publish the volume than to wait till the never-to-be-reached time when the "last word" could be said upon the subject.

Thoroughness characterizes the work. Each case of especial interest as it occurred was individually studied, and with an artist to aid him, the brush, the pencil, or the camera has perpetuated the salient features of the case.

The book is divided into four sections, and these in turn into chapters. The basis of the subdivisions has been an anatomical one. In each chapter the embryological development and ultimate anatomy of the member in question are first thoroughly explained. The most common lesions that faulty development produces is then described or depicted; finally, the surgical procedures and even the instruments and lines of operation necessary to correct the defect are given. It will easily be seen, therefore, that the volume is made up of a series of sections, each of which is more or less independent of all the others.

In Section I the defects of the spinal column are first considered, spina bifida being, of course, the most important and

frequent lesion observed. The skull, the brain, the face, and the neck are the subjects of the other chapters in this section, and hydrocephalus, harelip, and branchial cysts receive especial attention.

The thorax, the umbilicus, the genito-urinary organs of both sexes, and the intestines are the chapter headings of Section II.

Section III deals first with those vices of development which are common to both upper and lower extremities, ectromelie, hemimelie, and phocomelie. The upper extremity is next considered, and finally the lower extremity. In the last section congenital dislocation of the hip is thoroughly described.

Tumors and cysts of congenital origin remain to be considered, and this discussion forms the closing section of the volume. Angiomata, lipomata, dermoid cysts, and teratomata, congenital hypertrophies, and tumors malignant in character are the chief topics.

The material thus collected and studied is new, the methods of treatment recommended are modern and conservative, and the conclusions are founded upon extensive and accurate anatomical knowledge. The resulting volume must, therefore, be regarded as a valuable addition to surgical literature.

HENRY P. DE FOREST.

ATLAS OF SYPHILIS AND THE VENEREAL DISEASES, including a Brief Treatise on the Pathology and Treatment. By PROF. DR. FRANZ MRACÉK, of Vienna. Edited by L. BOLTON BANGS, M.D., of New York. 71 colored plates and 120 pages of text. Philadelphia: W. B. Saunders, 1898.

The fourth volume in this series of hand atlases is now at hand. Like its predecessors, the original work has been done by a German, but the result is more satisfactory from a pictorial point of view than that of the second and third volumes, recently published. In this atlas the recorded observations were originally made under the supervision of Professor Mracék, of Vienna, who in the K. K. Rudolfsplatz had an almost unlimited number

of cases from which to make a selection. In the preface of the American edition attention is called to the fact that the selection of cases has been governed by a practical wisdom that is not often shown in similar works. Each case selected was painted from life by the artist, A. Schmitson. As this factor is of paramount importance in the production of such an atlas, it is but just to say that this artist's work has been unusually satisfactory, and the colored plates are therefore excellent. A few photographs are also reproduced.

Syphilis, of course, furnished the large majority of lesions for study. Their name is legion, and the choice must of necessity be limited to a good type of each variety. Primary sclerosis of genitalia, lip, fauces, or other site of initial lesion, are first reproduced; then follows the principal general eruptive symptoms, macular, papular, or pustular, and finally those later manifestations of the disease that affect the eye, the scalp, the mouth, the breasts, or other localized portions of the body. Hereditary syphilis is also depicted.

Although frambœsia, or "yaws," is not so infrequent in the West Indies, it is a rare affection in continental America; two cases are included.

The venereal ulcer or soft chancre and the suppurative adenitis by which it is so often followed, is the next venereal disease to be described, and finally the lesions of gonorrhœa or its complications.

In the text, which supplements the plates in each instance, is a brief clinical history of the case, with the treatment and result. At the close of the volume a more extensive, but still concise, treatise is appended. This is not especially noteworthy in the description of the symptoms or diagnosis of the diseases, but in the matter of treatment, the inunction method, used for many years in European hospitals, but to a much less extent in this country, is described in detail, and many special formulæ are given for this and other medication. The results obtained are good, and the circulation of the volume will doubtless induce

many to try this method in private practice who have hitherto relied upon oral medication in their efforts to combat the disease.

HENRY P. DE FOREST.

TRANSACTIONS OF THE FRENCH SURGICAL ASSOCIATION,  
Eleventh Congress, October, 1897. Published under the  
direction of DR. LUCIEN PICQUÉ, Secretary-General. 8vo,  
pp. 959. Paris: Félix Alcan.

This large, well-printed volume is the official record of the work of the "Association Française de Chirurgie," at its eleventh annual meeting, held in Paris, October 18 to 23, 1897, under the presidency of Professor Gross, of Nancy. For this meeting there were selected as formal subjects for discussion contusions of the abdomen, and the operative treatment of cancer of the rectum. These subjects occupy respectively one hundred and one hundred and thirty-four pages of the volume. The discussion on contusions of the abdomen was made the subject of an editorial article in the *ANNALS OF SURGERY* in the issue of March, 1898, in which a full abstract of the communications made was presented. The rectal cancer discussion was introduced by a paper by Quénu and Hartmann, of Paris, which was followed by papers pertinent to the subject by Julliard, of Geneva, Polosson, of Lyons, Berger, of Paris, Gallet, of Brussels, Péan, of Paris, Boeckel, of Strasbourg, Heydenreich, of Nancy, De Page, of Brussels, Moulonguet, of Amiens, and Tailhefer, of Toulouse. The general consensus of these surgeons was against free osseous resections, and in favor of preliminary colostomy. The key-note of Quénu's contention was that the cancerous rectum should be taken away as if it was a cyst with septic contents.

In addition to these discussions, there are presented some eighty-two papers upon various surgical themes, classified according to the regions of the body involved. The activity and progressive character of the French surgery of the day are well demonstrated by the contents of this volume.

LEWIS S. PILCHER.

## CORRESPONDENCE.

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### INFLATION OF THE BLADDER AS A PRELIMINARY TO SUPRAPUBIC CYSTOTOMY.

*Editor ANNALS OF SURGERY:*

SIR,—Since the publication of my article, in 1893, on air-distention of the bladder in suprapubic cystotomy, I have received not a few letters expressing satisfaction with the method, and a number of articles on the subject have appeared in different journals. I have for myself been content to leave the method with the surgeons of this and other countries without further comment, certain that, if the innovation was of real value, it would ultimately supplant other more dangerous and less convenient methods of elevating the peritoneal fold and bringing the bladder within reach. If one is content to use no aid for this purpose, but prefers to fish for the viscus behind the symphysis, to such the method will not appeal. It may be questioned, however, whether this manner of reaching the bladder does not inflict more injury on the prevesical tissues, precisely what ought to be avoided, than other modes which involved the use of artificial aids. In 1897, Dr. F. Tilden Brown, in an article commenting on my method, made what I have since found a most valuable suggestion, which entirely does away with the necessity of measuring the quantity of air put into the bladder. He cuts down to the transversalis fascia and then inflates. Thus, with the finger in the wound, he is able to very accurately appreciate both the position and degree of tension of the bladder. I have adopted this suggestion, and it is often possible to see the peritoneal fold rise into the upper angle of the wound. Dr. Jepson's device for measuring the air, which appeared in his article, in the

September ANNALS, is most ingenious, and, if the skin-incision is to be made after the inflation, will prove a valuable safeguard. Where I have felt at all dubious as to the strength of the bladder walls, as in old men, I have adopted a suggestion of Dr. W. C. Wood, of this city, and used the double bulbs of the cautery apparatus. It is obvious that the secondary bulb is a most efficient safety apparatus. I am a little surprised that those of my colleagues, who have been kind enough to notice my method, should consider it necessary to filter the air, for it is evident that on the incision being made into the bladder the unfiltered air of the room must enter the viscus, nor can this thereafter be excluded until natural processes have closed the wound. I have therefore never used a filter, unless in cases where the air was used merely as a test of the integrity of the bladder. One of the surgeons quoted by Dr. Brown states that he found difficulty in retaining air in the bladder. This has never happened to me, when I have injected the air through a catheter, except once, when it escaped alongside. When an assistant, at my request, compressed the penis with his hand, the escape ceased. To conclude, I believe that the simpler the details of any operation the better. Therefore I use as few appliances in performing a suprapubic cystotomy as possible. I now cut down to the transversalis fascia, put my finger in the wound and then cause the bladder to be inflated through a catheter, either with a bicycle pump or Paquelin bulb, without the interposition of a filter. I am thus able to avoid the necessity of measuring the air introduced. I subsequently invariably use the method of Keen or Dawbarn for maintaining suction drainage after operation. By the aid of either of these devices it is possible to keep the bladder empty, so that the dressings are not even soiled by the escape of urine through the wound.

A. T. BRISTOW.

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# TUBERCULOSIS OF THE MAMMARY GLAND.<sup>1</sup>

By A. E. HALSTEAD, M.D.,

OF CHICAGO,

ASSOCIATE PROFESSOR OF SURGERY AND CLINICAL SURGERY IN THE NORTH-  
WESTERN UNIVERSITY MEDICAL SCHOOL,

AND

E. R. LECOUNT, M.D.,

OF CHICAGO,

ASSISTANT PROFESSOR OF PATHOLOGY, RUSH MEDICAL COLLEGE.

## HISTORY.

THE history of mammary tuberculosis dates from the publication, in 1836, of Sir Astley Cooper's work on diseases of the breast.<sup>1</sup> Under the title of "Scrofulous Tumors of the Breast" he gives a very fair description of the most striking clinical features of this disease, as follows: "In young women who have enlargement of the cervical absorbent glands I have sometimes, though rarely, seen tumors of a scrofulous nature form in their bosoms. They are painless, distinctly circumscribed, smooth on their surface, and scarcely tender on pressure. They can only be distinguished from inflammatory conditions by absence of tenderness and by the existence of disease of a similar nature in the absorbent glands of the other parts of the body. They produce no dangerous effects and do not degenerate into malignancy. They do not require operation, and, indeed, it would be impossible to remove them. But I have seen them removed from an error in judgment respecting their nature, and when

<sup>1</sup> Read before the Cook County Hospital Alumni Association, June 30, 1898.

cut into after extirpation they were found to be composed of loose, curdy fibrin, unequally organized."

Three years after the publication of Cooper's work, Nélaton<sup>2</sup> ("Thèse d'Aggregation," 1839) describes a case of tuberculosis of the breast upon which he had seen Gerdy operate. "This case," said Nélaton, "was unquestionably of tubercular nature without any concomitant lesions. The tumors, six in number, formed a mass which, before the operation, raised the skin and caused a prominence in the form of a nodular tumor. They were in every point similar to those which are at times found in the brains of children, and, like them, had the color and density of cooked chestnuts."

In 1842, Bérard<sup>3</sup> reported two cases of tumors of the breast that he regarded as tubercular. In each the tumor was at first hard, freely movable, and not attached to the skin. Later they softened and finally suppurated. Finally, fistulae were established, through which escaped a thick puriform matter, containing shreds of broken-down tissue and cheesy material.

Five years later Johannet<sup>4</sup> recorded a case of a woman, of forty years, who suffered from a tubercular inflammation of the axillary glands, which was followed by a tumor of the breast on the same side. The patient finally succumbed to lung tuberculosis. On post mortem Johannet found numerous nodules of various sizes, and representing all stages of degeneration common to tubercular disease.

Heyfelder's case<sup>5</sup> (1851) was the next one reported. This is of particular interest, inasmuch as the disease occurred in a man twenty-six years of age and otherwise healthy. Recovery took place after incision and drainage. This is the first recorded instance of tubercular disease in the male breast. Three cases have since been reported. That of Horteloup<sup>6</sup> (1872) and Poirier<sup>7</sup> (1883). In the first the patient, besides the disease of the breast, suffered also from a tubercular testis, which necessitated castration. In the second (Poirier's) the axillary glands were also the seat of a tubercular disease.



Another is referred to by Delbet,<sup>8</sup> but no details are given.

Velpeau,<sup>9</sup> in his "*Traité des Maladies du Sein*," in 1856, speaks of tumors of the breast which he thought to be tubercular, and which in many instances closely resemble similar conditions found in the lymphatic glands. Those that he had observed he classed under three heads: (a) Disseminated tubercles; (b) multiple lymphatic tumors; (c) lymphatic suppurating (or caseating) tumors.

In 1860, Lanceraux and Charbley<sup>10</sup> each published a case of mammary gland tuberculosis. In both of these cases a careful histologic study of the tumor led to a diagnosis. To Lanceraux is due the credit of being the first to make a diagnosis based upon the histologic structure of the part removed.

Between the years 1860 and 1880 Billroth,<sup>11</sup> Holmes,<sup>12</sup> Horteloup,<sup>6</sup> Richet,<sup>13</sup> and Klotz<sup>14</sup> reported cases, and described the clinical characteristics of this disease. With the single exception of Lanceraux, no one had up to this time studied the histological structure of these tumors, but all had based the diagnosis upon macroscopic appearance of the lesion. At about this time Cornil<sup>15</sup> and Ranvier and Virchow<sup>16</sup> maintained that no authentic case of mammary gland tuberculosis was on record, and that the cases published were not to be considered as such. However, in the light of subsequent research we must regard many of the cases described by the early writers as true examples of tuberculous disease of the breast.

The second epoch in the history of mammary gland tuberculosis, that in which the diagnosis was based not alone upon the clinical symptoms and macroscopic appearance of the lesion, but upon the histologic structure and the presence of tubercle bacilli, began with the presentation of Dubar's<sup>17</sup> thesis ("*Des Tubercules de la Mamelle*") in 1881.

In this work, which is by far the most important paper contributed on this subject, the author carefully reviews the literature and analyzes the cases reported up to his time. In

addition, he reports two new cases which he had observed; one in the service of Gosselin and the other in that of Le-Dentu. A careful microscopic study of each was made, and the diagnosis based upon the histologic structure of the tissue, in which he was able to demonstrate the characteristic elements of a tubercular lesion.

From a pathologico-anatomical stand-point he divided mammary tuberculosis in two classes: (1) Isolated or disseminated nodular tuberculosis; (2) confluent tuberculosis. In the first he regarded the disease as primary, in the mammary gland, in the majority of cases. In the second the disease might result from a softening and breaking down and coalescence of the nodules in the disseminated form, and is frequently secondary to tuberculosis of some other organ, usually of the axillary glands.

In 1882, Duret<sup>18</sup> reported two cases, in one of which microscopic examination, made by Nepveu, confirmed the diagnosis of tuberculosis made by Duret. In the other no examination of the tissue was made, but the presence of an axillary adenitis, which antedated the disease of the breast, made the diagnosis reasonably sure.

In the same year Ohnacker<sup>19</sup> recorded two cases, in which microscopic examination showed typical tubercles. He also implanted in rabbits tissue from each, and was able to demonstrate the presence of tubercle bacilli, on killing the animals, six weeks later.

Crandall<sup>20</sup> and Poirier<sup>7</sup> in 1883, and Durant<sup>21</sup> and Courdray<sup>22</sup> in 1884, each reported cases, but in none of these was a microscopic demonstration of the tubercular nature of the lesion made.

Verchère<sup>23</sup> in 1884 described in detail a case of primary mammary tuberculosis, operated on by Verneuil, in which tubercle bacilli were found in great abundance in the acini of the gland.

Orthmann<sup>24</sup> in 1885 published a paper in which he reported two cases. In the first tubercle bacilli were found in the mammary gland and milk-ducts. In the second no tu-

bercle bacilli were found in the mammary gland, but in the axillary glands on the same side they were found in great numbers.

In a case operated upon by Souplet<sup>25</sup> (1886) for carcinoma, Cornil was able to demonstrate the tubercular character of the tumor, although no bacilli were found.

Piskacek<sup>26</sup> in 1887 published a report of eight cases that had come under his personal observation. In two of these the diagnosis was based upon a microscopic examination. In the other six no microscopic study had been made, but all had the clinical characteristics of tubercular disease of the mammary gland.

Dubruel<sup>27</sup> reported two cases, one in 1888 and the other in 1890. The latter is of interest, as the breast had been amputated for what was considered a fibrosarcoma. On microscopic examination it was shown to be tuberculosis.

The following two years reports of cases were made by Kramer,<sup>28</sup> Campenon,<sup>29</sup> Shattock,<sup>30</sup> Hebb,<sup>31</sup> Herring,<sup>32</sup> Heurtaux,<sup>33</sup> and Birchold.<sup>34</sup> In the latter's inaugural thesis on this subject he reviews the older literature and reports six cases observed by himself. In the other reports of cases nothing of particular interest is to be noted.

Roux's<sup>35</sup> inaugural dissertation, which appeared in 1891, presents a complete review of the cases, thirty-one in number, which had been published up to that time. He reported three new cases, all of which had been subjected to a careful microscopic examination. In two of his cases he was able to demonstrate the presence of tubercle bacilli. In one no tubercle bacilli could be found, although the histological structure of the tumor placed the diagnosis beyond doubt.

The same year Mandray<sup>36</sup> published a report of six cases observed by him. In only one could tubercle bacilli be found, although all were carefully examined.

About this time cases were also reported by Reverdin,<sup>37</sup> Ely,<sup>38</sup> Bender,<sup>39</sup> Lane,<sup>40</sup> and Robinson.<sup>41</sup> The latter, after carefully considering the question of the mode of origin of

mammary tuberculosis, concludes that it is not primarily an infection of the gland proper, but first of the connective tissue with subsequent invasion of the gland.

In 1893, Ludwig Müller,<sup>42</sup> in his inaugural thesis, partially reviewed the literature of this subject. He also reports a case operated upon by Schoenborn, where the diagnosis of carcinoma had been made, but which, on microscopic examination, was demonstrated to be tuberculosis. The same year Remy and Noel<sup>43</sup> reported a case, which is of interest because of the advanced age of the patient. In this case the disease occurred in a woman of fifty-three years, long past the menopause, and in which no other evidence of tuberculosis could be found.

In the reports presented by Jaques,<sup>44</sup> Schede,<sup>45</sup> Powers,<sup>46</sup> Spediacci,<sup>47</sup> and Villard<sup>48</sup> new cases were recorded, and some of the older papers reviewed, but nothing new was added. Powers reports two cases treated in the service of Dr. Bull, in both of which the diagnosis was based upon the microscopic findings.

In an exhaustive paper, based upon the study of mammary gland tuberculosis, both in man and in the cow, Angelo Forritini<sup>49</sup> concludes that mammary tuberculosis in the cow, unlike that in man, is, in the vast majority of cases, secondary to tuberculosis of some other organ, frequently of the pleura or lung, and that it is usually of the miliary variety, and extremely difficult to recognize clinically.

Among other papers on this subject, published during the years 1894 and 1895, are those of Reerink,<sup>50</sup> Gautier,<sup>51</sup> Gaudier and Peraire,<sup>52</sup> Pillet and Walther,<sup>53</sup> Mermet<sup>54</sup> and Brissay.<sup>55</sup>

Gautier, in his thesis, collected and analyzed seventy-seven cases, which had been reported up to this time. In forty-three the lesion was demonstrated to be tubercular, either by histologic or bacteriologic examination.

In a recent article Sabrazes and Binaud<sup>56</sup> review the history and present their views on the pathologic histology and pathogenesis of mammary tuberculosis.

This, from a pathological and histological stand-point, is by far the most comprehensive exposition of this subject that is found in the literature. The conclusions that are reached, after a searching analysis of the works of preceding writers and from a careful examination of their own cases, regarding the pathologic anatomy and histogenesis of mammary gland tuberculosis, will be referred to in another part of this paper.

In closing the history of this subject I need only mention that Powers, of Denver, has lately reported a case where he amputated a breast for what he considered mammary cancer, but on microscopic examination it was found to be tuberculosis.

A. H. Ferguson,<sup>57</sup> of Chicago, in a recent paper read before the Chicago Academy of Medicine, reported three cases, in one of which the disease occurred in the male. In none of these was a microscopic examination made.

#### SYMPTOMATOLOGY AND CLINICAL COURSE.

In the beginning mammary tuberculosis may not present any recognizable symptoms. As the disease progresses the symptoms vary according to the form which the tubercular lesion assumes. It is readily apparent that, in a patient afflicted with an advanced tubercular disease of the lungs or some other organ, a small tubercular nodule in the breast might easily, during life, escape notice, and be found only on post-mortem examination. Such cases are, however, of no clinical interest, and do not concern us.

In the disseminated nodular or discrete type of the disease the nodules may be either single or multiple. The breast generally preserves its normal size and appearance. In only a few cases is the volume appreciably augmented or its contour changed. The skin covering the gland is normal in appearance, not adherent to the intraglandular mass, and without any fistulæ opening on its surface. On palpation we find one or more nodules which are movable, hard, and only slightly painful on pressure. Their outline is, as a rule,

distinct, though at times they may be ill-defined and apparently merge into the surrounding normal gland tissue. These slowly increase in size, soften, and undergo caseous degeneration or suppuration, and in the end form fistulæ, from which is discharged tubercular pus. The nodules may, before fistulæ are established, so enlarge that one or more may coalesce, forming tumors of considerable size, which ultimately terminate by discharging their contents through fistulous openings. In cases where there are a number of nodules they are usually distributed throughout the gland. When a single nodule is present, it is nearly always formed in the upper and outer quadrant of the organ. Delbet found that in eighteen cases, where the exact seat of the tumor was noted, in ten it was situated in the upper and outer portion of the breast. In two it was nearly in the centre.

The most characteristic features of the disseminated nodular form of this disease are the extreme chronicity of the process and its painless and insidious development. In many cases the nodules remain stationary for years without causing any subjective symptoms that cause the patient to seek medical advice. In the end, however, nearly all become slightly painful, gradually enlarge, and undergo the degenerative changes common to all forms of tubercular disease. When softening has taken place, before the cavities coalesce, fluctuation may be detected. In most cases, however, the cavities are so small that it is impossible to elicit this sign.

The confluent form of the mammary gland tuberculosis is characterized by a more acute onset, greater pain, and rapid enlargement of the breast.

On palpation we find a tumor usually single; varying in size from that of a walnut to an orange, of irregular outline, nodular, and fluctuating. The gland is generally uniformly enlarged. The tumor, if single, is usually found in the outer half. This type of the disease is more common than the disseminated nodular form. In many cases fistulæ form early, and it is in this condition that the surgeon frequently first sees the patient.

The initial symptoms of the disease may vary in individual cases from the typical form, as described. In one of Orthmann's cases the disease began as a small subcutaneous focus of inflammation resembling a furuncle. The base of this inflammatory mass became indurated and later formed a nodule of considerable size.

In Kramer's case there first appeared a small ulcer near the nipple. Later nodules formed deep in the breast and were connected by a band of indurated tissue with the ulcer.

In two recorded cases retraction of the nipple was the first symptom noted. In one case (Dubrueil's) the retraction was noticed six months before the tumor was recognized. In Verneuil's case retraction of the nipple began shortly after confinement. It was only after five years, during which time the retraction had gradually increased, that a tumor was discovered.

In about 75 per cent. of the cases reported there was a tuberculous adenopathy affecting the axillary glands on the same side as the breast lesion. In many cases (eight in thirty-seven cases collected by Berchold) the disease was primary in the axillary glands and secondarily involved the mammary gland. This is regarded by Verneuil as the usual method of infection of the breast. However, it may be said that in many cases the primary focus in the breast escapes notice until after the axillary glands are considerably involved.

Again, the disease in the axillary glands, even when secondary, usually advances with greater rapidity than that in the mammary gland, so that while the axillary glands may be broken down and suppurating the nodule in the breast may remain stationary for a considerable length of time. The glands distributed along the lower border of the great pectoral muscle, as well as those above the clavicle, are at times involved, occasionally primarily though usually secondarily. In some cases in which the axillary glands are involved the tumor in the breast has been found joined to the axillary tumor by a band of indurated tissue which could be distinctly

palpated. When this is present it is regarded as a characteristic sign of mammary tuberculosis.

As in other forms of tuberculosis, softening and suppuration with the formation of fistulæ is the natural and frequent termination of all types of mammary tuberculosis. Spontaneous healing of tubercular foci in the gland before suppuration takes place seldom, if ever, occurs. After the cavities have discharged their contents it is only in exceptional cases that healing takes place. Usually new foci of inflammation are established, and frequently neighboring structures are involved before complete cicatrization of the old is accomplished.

*Pathologic Anatomy.*—The morbid anatomy of tuberculosis of the mammary gland includes, according to Dubar,<sup>17</sup> two forms,—a disseminated and a confluent. To these Roux<sup>35</sup> has added a third, the intraglandular cold abscess. It is at once evident that this last form is but one termination of Dubar's confluent form. From the anatomical standpoint, however, it none the less deserves a position of equal importance with the confluent and disseminated forms, on account of its positive peculiarities.

In the first of these, the disseminated tuberculosis of the mammary gland, there is very little or no increase in the size of the organ and the skin is unbroken by fistulæ. On section distinct, firm nodules are found, which vary in size from a pinhead to an almond. Their yellowish or wax-colored centres are surrounded by a zone of grayish or bluish-gray, slightly translucent tissue, and the separate foci are isolated by healthy gland tissue. The gland tissue immediately adjacent to the alien areas is firmer than normal. Various areas show a diversity in the character of the central portions, some more gray, some more yellowish, and some, according to Baubet ("Du Tubercule au Point de Vue chirurgicale," 1857), may be calcified.

In the confluent form the gland is commonly enlarged, even to double its usual size, but the enlargement is seldom



symmetrical; for example, the external half can be much more increased in size than the remainder of the gland.

Opening into that portion which is most enlarged are one or more fistulæ. The gland is firmer than normal and this firmness is as a solid mass. The individual areas of induration are not separately movable as in the disseminated form, but seem to be fused together. In a few places where the consolidation is less marked a few distinct, hard, and smaller districts can be felt.

On section through that part which is judged to be most changed, it is found to be made up of cavities, irregularly spherical and flattened, with multiple diverticulæ. Some that are apparently separate and independent are found, on closer examination, to be connected by minute sinuses, with neighboring cavities. The walls of these cavities are roughened by small cup-like depressions separated by ridges, giving to the whole an areolar appearance. The lining of these cavities is a soft, grayish membrane, one to two millimetres thick, with here and there yellowish points. Externally it sends fibrous prolongations into the adjacent tissue. The gland tissue surrounding the cavities is of increased firmness for a distance of from two to three centimetres, grayish pale, and fibrous. In this are small pinhead-sized, grayish, or finely transparent areas projecting slightly above the cut surface. These minute foci are more numerous in the tissue surrounding than in the wall itself. The larger cavities communicate by fistulæ with the exterior, and these channels possess lining membranes similar to those of the cavities. Ordinarily only one breast is affected and the axillary glands are involved.

That form of mammary gland tuberculosis characterized by a cold abscess is rare, and has not been observed before puberty; as a rule, it follows pregnancy or abortion. Of slow development, it is frequently confounded with tumors; located in the gland, it leads to retraction of the organ and slight œdema of the surrounding parts. There are no tubercles in the wall or in the surrounding tissue. Lined by fungus-like, reddish, or purplish membrane, it contains a thin

pus with grumous masses, grayish and yellowish, and of various sizes.

As to origin, several possible routes are recognized. Although constant reference has been made by the writers on this subject to infection *via* the gland ducts, too little emphasis has been attached to the fact that this would give origin to a pericanalicular process, the tuberculosis being disseminated, here as elsewhere, by the lymph-channels. It is more probable that most of the cases do not possess such an origin, but are due instead to a retrogressive lymphatic tuberculosis from the axilla or from the thoracic cavity. A primary mammary gland tuberculosis has yet to be confirmed by autopsy. A hæmatogenous origin is not to be ignored, and a number of cases are reported where, at the autopsy, a general miliary tuberculosis was present.

In two cases reported by Velpeau the tuberculosis present—in each instance in both breasts—was accompanied by a tubercular lymphadenitis quite generalized, and Heyfelder cites an instance where an adjacent rib was carious.

Considerable controversy has been had over the origin of the giant-cells in this process. Orthmann,<sup>24</sup> Piskacek,<sup>26</sup> Roux,<sup>35</sup> Müller,<sup>42</sup> Bender,<sup>39</sup> and Delbet,<sup>8</sup> following the ideas launched by Dubar,<sup>17</sup> have maintained that the giant-cells were the product of changes in the glandular epithelium. Sabrazes and Binaud,<sup>56</sup> and following them other writers, have assigned their origin here as elsewhere, according to the Baumgarten doctrine, to the mesoblastic cells.

The paucity of bacilli is a point of common comment. In seventy-seven published observations (Gautier,<sup>51</sup> p. 39) bacilli have been discovered twenty-two times. Habermaas<sup>58</sup> found two bacilli in twelve microscopic preparations, Piskacek<sup>26</sup> a few only in 400 preparations, and other observers have examined more than 100 sections, using various methods, and failed to find any bacilli.

*Diagnosis.*—In many cases the diagnosis of mammary tuberculosis cannot be made from the clinical symptoms and macroscopic appearance presented. In those cases where

the disease in the breast is far advanced, or those in which other organs of the body are the seat of tubercular disease, we can without difficulty arrive at a proper diagnosis of the existing condition in the mammary gland.

In the early stages of the discrete or disseminated nodular form of primary mammary tuberculosis, especially in those where no axillary adenopathy is present, a positive diagnosis can never be made without a microscopic examination of the tumor. In practically all of the cases reported of this variety, and under these conditions, a correct diagnosis has not been made previous to the removal of the nodule. The conditions most likely to be confounded with mammary tuberculosis of the disseminated nodular type, in its early stages, are adenofibroma, sarcoma, simple cysts, carcinoma, and gummata.

In adenofibroma the growth of the tumor is slow, as in nodular tuberculosis. These tumors also occur in young adults, as is the case in mammary tuberculosis. They both at times develop very rapidly during or after lactation.

Adenofibromata frequently undergo a cystic degeneration, and in this way closely simulate the changes which occur in a tubercular nodule.

Adenofibromata differ from tubercular nodules in that they are freely movable in the breast, because of the capsule in which they are enclosed. In tuberculosis the nodules are at times quite movable, but usually are not, because of the fibrous tissue surrounding them, which is intimately adherent to the gland tissue. Again, adenofibromata are relatively common, while tuberculosis is not. The most characteristic feature, however, is the presence of disease in the axillary glands. This occurs in the great majority of cases of mammary tuberculosis, and, as before stated, often precedes the disease in the mammary gland. When the nodules soften and break down, by aspiration of the contents, we may determine the nature of the disease. Before this occurs, even after the tumor has been removed, in the absence of a concomitant axillary tuberculosis, the diagnosis cannot be made without a microscopic examination of the tissue.

We distinguish sarcoma from tuberculosis of the breast principally by the rapidity of its growth. In sarcoma of the breast the tumor grows with great rapidity, quickly involves the skin, and causes it to slough away. Tuberculosis is an exceedingly chronic disease, especially the form under consideration, and, while the skin may be invaded late, it practically never occurs before the axillary glands become involved and suppurate. In sarcoma the cutaneous veins are greatly enlarged from the beginning, and pain is a prominent symptom. In tuberculosis the appearance of the breast is not materially changed, and only in rare cases is there any pain. In sarcoma we have single tumor, while in disseminated nodular tuberculosis, although we may have but a single tumor, in the majority of cases more than one is found.

In simple cysts, the presence of fluctuation early in the course of the disease, the absence of pain, absence of axillary adenitis, and the character of the fluid obtained by aspiration will be sufficient to allow us to make a diagnosis.

It is only in the early stage of carcinoma that any difficulty will be found in distinguishing it from disseminated nodular tuberculosis. We have in the age of the patient an important factor in determining the nature of the tumor. In tuberculosis of the breast the majority of the patients are between twenty-five and thirty-five years of age. In carcinoma they are mostly above forty. In only one case has tuberculosis of the breast been noted in a woman of advanced years. In this case the patient was fifty-three years of age, and presented no other evidence of tuberculosis. Again, in carcinoma the nodules are hard and show no tendency to break down and suppurate until after the skin is invaded. The axillary glands become enlarged early in both diseases. In carcinoma they do not suppurate, and are not painful as in tuberculosis. Pain is greater and the development of the tumor much more rapid in carcinoma than in tuberculosis.

Gummata of the breast may be mistaken for nodular tuberculosis. This form of syphilis of the breast is exceedingly rare, the usual manifestation of syphilis of the mammary

gland being the diffuse syphilitic mastitis. With gummata of the breast we usually have other evidences of syphilis upon which to make a diagnosis. In many cases the disease affects both breasts, while tuberculosis rarely does. The axillary glands are not, unless the gummata suppurate, more affected than the lymphatic glands in other parts of the body.

The confluent form of mammary tuberculosis may, in the early stage of the disease, be confounded with any of the new growths found in the breast. The irregular nodular form of the tumor, the increase in the size of the breast, and the presence of an inflammation of the axillary glands, with rapid softening of the glands and of the mammary tumor, are sufficient data upon which to base a diagnosis. In the later stages of the confluent form, when fistulæ are present, the tumor may be mistaken for carcinoma, sarcoma, and actinomycosis. In the scirrhus form of mammary cancer, the early retraction of the nipple, the hardness of the tumor, and the pain, which are characteristic, are not found in mammary tuberculosis as a rule. In mammary cancer, although the skin may be destroyed by ulceration, yet there are no fistulæ leading down deep into the gland tissue. The axillary glands, although early involved, do not suppurate as in tuberculosis.

In the soft form of carcinoma, the rapidity of the growth, the early destruction of the skin, with the foul sloughing character of the ulceration show the character of the tumor.

Sloughing sarcoma may be distinguished from the late stage of confluent mammary tuberculosis by the rapidity of its growth and the size of the tumor, which is very much greater than in confluent tuberculosis. The axillary glands are affected only late in the disease, if at all, in sarcoma.

Primary actinomycosis of the mammary gland may closely simulate confluent mammary tuberculosis, especially when fistulæ are formed.

In mammary actinomycosis the axillary glands are only rarely involved. The macroscopic character of the pus would, if closely examined, suggest the nature of the infection, but

in no case could a positive diagnosis be made without a microscopic examination.

In all cases a microscopic examination should be made, and the diagnosis based only upon the histologic structure of the tumor or upon the presence of tubercle bacilli. It is only in this way that any early diagnosis can be made and rational treatment instituted.

*Treatment.*—In disseminated nodular or confluent tuberculosis of the mammary gland early removal of the breast and the axillary gland on the same side offers the greatest hope for a speedy and permanent cure. Nothing short of this can assure an eradication of the disease. In all cases of *primary* mammary tuberculosis the prognosis, after such an operation, is excellent. In secondary tuberculosis of the gland the prognosis, of course, depends upon the seat and extent of the primary lesion. In the discrete nodular form, where the disease is limited to one focus of inflammation, the remaining portion of the gland appearing normal, the removal of the nodule together with the gland tissue immediately surrounding it will be sufficient, providing the patient can be kept under observation for some time after the operation.

In those rare cases of cold abscess of the breast not associated with tuberculosis of the axillary glands, or in those in which a radical operation is contraindicated, aspiration of the abscess and injection of iodoform emulsion may be employed.

*CASE.*—Mrs. J. E. J., colored, aged 29 years, married, applied in June, 1896, at the Surgical Clinic of the Northwestern University for treatment. Family history good; parents both living and healthy; no history of tuberculosis. Venereal history denied. Past illness: Has always been well. Personal history: Has had two children; eldest three years old; youngest fifteen months; had nursed the last until six months ago, when secretion of milk ceased for some unknown reason. Present illness: Began about five months ago, when patient first discovered a nodule in the right breast. At the time when the tumor was first noticed it was about the size of an almond nut and very slightly painful.

From that time it has gradually increased in size and become a little more sensitive on pressure. At times there are shooting pains in right breast radiating down the arm. Examination shows an apparently healthy woman; no scars or other evidence of syphilis; chest negative; abdomen negative. In the right breast, in the upper and inner quadrant, there is a tumor, freely movable, hard and somewhat irregular or nodular in outline. The breast is not perceptibly enlarged, nor is there any discoloration of the skin or retraction of the nipple, nor any abrasion of its surface. The axillary glands are not changed. No enlargement of the supraclavicular or cervical gland. Clinical diagnosis: adenofibroma. Treatment: Excision of the nodule and the surrounding fibrous tissue. Subsequent course: Uneventful. Wound healed by primary union. No sign of any disease in the breast one year after operation.

*Pathologic Examination.*—Examination of the specimen shows a hard mass, the size of an English walnut, roundish in shape, slightly lobulated, and fusing gradually with the surrounding tissue. On section, it is grayish and has all the appearance of fibrous tissue; it cuts with resistance, but there is no grating sensation imparted. Irregular radiating bands of fibrous tissue jut out at various points from the central firmer portion. There are no points of softening.

A number of small pieces were embedded, sectioned, and stained with hæmatoxylin and eosin, and mounted in series. Sections from a few blocks thus prepared showed them to consist almost exclusively of heavy fibres, such as are met with in cicatrices, in pure fibromata of the hard type, and particularly those met with in the mammary gland. These fibres are not of equal or uniform width, but show bulgings at certain points. A few short, undulating, glistening, transparent, narrower fibres, reminding one of elastic tissue, are met with among the heavy fibres. The heavy bands stain with eosin; the narrower fibres do not stain with the Orceine stain for elastic tissue, nor with the eosin. The fibres are arranged around ducts, blood-vessels, and gland remnants. Many areas of considerable extent in this fibrous tissue are devoid of cells or cellular elements; in other areas cells or nuclei are sparsely distributed; in still others they are more numerous.

Only seldom do these scattered cells show any cell body which can be distinctly made out as such. They show all



varieties in shapes, occasionally, when roundish or oval, possessing a narrow zone of protoplasm; the nucleus of such is then located at one pole of the cell or at one corner, for many are oblong or more nearly square.

The apparently naked nuclei are much distorted or markedly drawn out and slender. When so fibrillated they mark in a striking manner the direction of the fibres of the tissue containing them, as they lie compressed between the fibres.

Here and there in the tissue so far described are groups of cells whose arrangement leaves no doubt but that they represent



FIG. 1.—Cicatrizing tubercle; numerous large, typical giant-cells.

remnants of glandular tissue, gland epithelium. In certain of these groups the arrangement about a lumen is entirely wanting, only three or four irregular rows of cells (but few of which show an easily made out cell body), disposed one around another, remain to mark the site of a former duct or acinus. In other groups the lumen is still present, and some of the lining cells still show a columnar or short cubical shape. These latter cell-groups are commonly found in bunches of from four to seven or more, exceptionally less than four. These gland remnants in some instances have the lining cells desquamated, and filling



up the lumen partially or completely. In others the lining cells are several cells deep for some part of the circumference ; again, the duct or acinus may be bare, devoid of any lining for a part of its circumference.

Only seldom is there any glandular epithelial tissue found in which there is a lumen lined for its entire circumference with a single layer of columnar or short cubical cells.

Around these ducts—which is to say between the single ducts of a group, since they occur in bunches—are many round cells, small, with well-stained nuclei, which occupy the main part of the cell. Some of these round cells have apparently no cell body. In places these round cells form intercanalicular foci, where they are quite numerous. In still other places they are very few in number or form a quite uniform sheet around the duct. It is in the places where the inter- and pericanalicular round-cell infiltration is marked and dense that the histological evidences of tuberculosis are met with. These vary from minute foci of round cells, which show nothing to signify their origin, to larger areas, which, with the exception of being partially cicatrized, offer complete resemblance to tubercles. The first of these—*i.e.*, the minute intercanalicular foci—are made up both of cells with round and more or less irregularly oval nuclei and of cells with spindle-shaped nuclei. On closer examination these areas show, first, numerous cells with large nuclei and a moderate amount of cell-body protoplasm. The cell outline is irregular, the nuclei also irregular in shape, more or less oval or oblong with notched edges, at times well-stained nuclear membrane, a more faintly stained nucleus, in which are commonly seen two or three chromatin granules. Occasionally some of these cells are somewhat fibrillated or compressed, in which case the body protoplasm is prolonged out into pointed processes. Second, there occur smaller cells in these foci with much more darkly stained nuclei, with scanty body protoplasm, and the divers shapes of the nuclei leave no doubt but that they are leucocytes of the polymorphonuclear variety, for they assume the horseshoe form, the trilobate form, and others equally characteristic.

As these foci become larger, as seen in sections of other portions of the material, they contain giant-cells. These giant-cells are, as a rule, very large, and in serial sections many sections are obtained of the same giant-cell. Some difficulty might

be had in differentiating these giant-cells from gland ducts or acini, in which the epithelium had become desquamated, for the nuclei of the giant-cells are about the same size as nuclei of the glandular epithelium, and, further, the giant-cells frequently contain many nuclei more or less filling up the cell body. However, the following facts establish that these are true giant-cells and not altered gland remnants. First, the giant-cells, although large, never show any fibrous wall or basement membrane around their periphery, as would be the case did they originate from gland remains. In the next place, they are located around large ducts, positively pericanalicular. And, lastly, there are found in the larger, partially cicatrized tubercles before men-

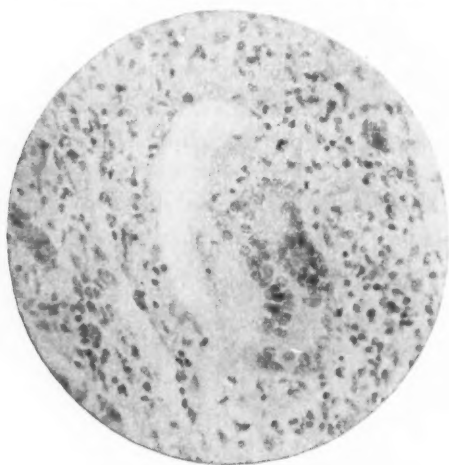


FIG. 2.—Giant-cell, space above due to contraction in alcohol; easily mistaken for gland remnant.

tioned, giant-cells which are in all respects similar to those described by Langhans. Not only this, but between these last and giant-cells, more easily mistaken for gland remnants, all transition forms of giant-cells may be found.

The large, partially cicatrized tubercles are found in places which show less of the fibrous tissue mentioned in the beginning, more gland tissue, more young granulation tissue, and large ducts, sometimes dilated, sometimes compressed. Many of these large tubercles are apparently made up of smaller tubercles, for they show giant-cells at various locations, and the embryonal cells are scattered here and there in groups.

Only exceptionally are tubercles found which show a central necrosis. When such occur the necrotic tissue is made up largely of chromatic granules. Immediately surrounding the necrotic tissue the cells are quite fibrillated. In these large tubercles, which show no necrosis, the substance of the area is cicatricial tissue of few cells and much fibrous tissue. The shape in general of these areas is circular, and in spite of the advanced stage of healing represented by the fibrous tissue in these areas they frequently contain numerous giant-cells. Some of these giant-cells, however, are flattened as though compressed, their outline irregular, and their ends frayed out. Some are found which show clefts parallel to the long axis, as though a part of the cell was split off, and many show leucocytic invasion. Here and there in these tubercles in the fibroblasts are found small accumulations of golden-brown pigment in the cell bodies. Numerous large "mastzellen" are also found. In the tubercles which are less cicatrized the appearances differ only in degree.

Tubercle bacilli were found only after a most persistent search, and then only in small numbers, and always adjacent to giant-cells. In a few instances small granules, stained red, with the carbo-fuchsin arranged in rows were seen, which would remind one of the so-called sporulated forms of tubercle bacilli, possibly of bacilli which were partially disintegrated.

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I. NOTE UPON THE PRESENCE OF THE CÆCUM  
AND APPENDIX IN LEFT FEMORAL  
HERNIE.

II. CASE OF INGUINAL HERNIA OF SMALL IN-  
TESTINE WITHOUT A PERITONEAL SAC.

By S. CATELLANI, M.D.,

OF PADUA,

FIRST ASSISTANT IN THE SURGICAL CLINIC OF PROFESSOR E. TRICOMI, IN  
THE UNIVERSITY OF PADUA.

I DESIRE to report two cases of hernia in women which I believe to be of some importance, one as a contribution to the study of hernia of the blind gut and vermiform appendix on the left, the other to that of lateral hernias. The first case was a strangulated femoral hernia, and so enormous that it reached down to the knees, containing at the moment of the operation the colon ascendens, with cæcum and vermiform appendix, the transverse and about half a metre of the small intestine. Besides this case being a real eventration cruralis, it is interesting because such an abnormal condition was for a long time consistent with life, and also because it was an example of hernia of the blind gut and vermiform appendix on the left. The most important statistics about appendix hernias are those given by Klein and Brieger and those by Baiardi, who added to the twenty-two cases mentioned by the former and to the twenty-five by the latter, fifty-one more cases, with a complete monograph on this subject. Fourteen cases besides were published last year by Briancon; none on the left. Baiardi's work can give us an idea of the frequency of cases of hernia of the blind gut and vermiform appendix on the left, because, after all, the hernia



Catellani's case of enormous left crural hernia, containing caecum and vermiform appendix.





of the appendix is mostly nothing but the first step to the development of those of the blind gut.

He has collected ninety-eight cases, and among them the hernia on the left was only found in two instances.

Hernia of the blind gut and of the appendix in general is much more frequent than has been hitherto thought, owing to the fact that many observations have not been published. Thus in five years of surgical practice I have seen and I have operated in Professor Tricomi's Surgical Clinic on 420 hernias, of these 295 were of the groin and 126 were crural. The appendix was found four times either alone or with the blind gut. None of these cases have been published. As for the frequency of the hernia of the blind gut on the left, according to Hildebrand, this would happen in 16 per cent. of the cases. I think, however, this is rather a high percentage; our statistics would give the percentage of 1 per cent.

The subject I briefly intend to describe refers to Lucia Coletta, aged forty-nine years, of Campodarsego, a country woman, married. She entered the clinic in a most serious state. She said that twenty-four years ago, during the labor of her confinement, she felt in the left crural region a violent pain, and noticed the appearance of a swelling as large as a hazel-nut. She applied nothing to it, and the swelling gradually increased, so that in three or four years it reached the size of the head of a full-developed fetus, and went on increasing until it grew to the size of an adult's head. This infirmity, till lately, only gave her slight disturbance, mostly felt, when walking, as an extreme weakness which disabled her from attending to very hard work.

The day before she entered the clinic she had several diarrhoeal discharges, and at once noticed an increase in the size of the swelling, with violent pains in the part and in the abdomen.

The increase in volume was so rapid and progressive that the swelling grew to double the size above mentioned. She vomited in the night and brought up what she had eaten the evening before.

On examination, a tumor, extending longways like the trunk of a cone with the base upward near the root of the thigh, reaches down to the knees; the tumor is distended, soft, elastic; on per-

cussion, in some parts it is dull, in others tympanitic. At the upper part it occupies entirely the large left labium, so much so as to make it disappear. The anterior surface of the tumor, from the base to the apex, is forty-two centimetres; posteriorly thirty-one centimetres; the circumference at the base fifty-nine, at the apex fifty-four. At twenty-one centimetres from the base, I perceived a prominent furrow which occupies only the anterior and lateral surfaces, and in connection with which the circumference is also fifty-four centimetres. (See illustration.)

The skin is thin, stretched, shiny, marked by numerous dilated veins. Pressure on the swelling and on the abdomen is painful. The abdomen presents a certain degree of meteorism. The general aspect of the invalid is that of a wearied and exhausted person, already thin and worn out; her features denoting keen suffering, and the cold perspiration, all contribute to indicate an exceptionally serious case; pulse feeble and frequent; temperature only  $38^{\circ}$  C.

On questioning her about the history of her ancestors, her father was known to have suffered with hernia and her mother to have died of an affection of the intestines. The patient had other illnesses, none, however, of much importance or etiologically connected with this illness.

The diagnosis is of eventration cruralis on the left, acquired and strangulated, and the operation followed with all speed without narcosis.

Having incised the skin as would be done in the case of a hernia cruralis, and reaching the opening of the hernia, it appears evident that we cannot replace the intestinal bulk, which is formed by about a metre of small intestine, the transverse and ascending colon, with the cæcum and vermiform appendix. The colon is of a blackish color and the sac is full of a greenish-yellow liquid, having a strong smell of sulphuretted hydrogen; the surface of the protruding bowels is covered with pseudomembranes.

To replace all the herniated bowels it is necessary to incise quite through the abdominal wall five centimetres upward. The reposition can thus be performed, and the suture by layers of the abdominal walls takes place, having previously excised a large portion of the skin in connection with the hernia.

The patient died eight hours after the operation.

At the autopsy the following interesting points were observed: Circumvolution of the small and large intestine, which are distended by gases and bloody liquids; the cæcum is attached by a mesentery which presents the length of forty centimetres; the mesentery of the small intestine is also very long (sixty centimetres), and very thick on account of fatty infiltration.

The intestinal region, which presents symptoms of strangulation, comprises one and a half metres of small intestine and eighty centimetres of cæcum and colon. There is no liquid in the cavity of the peritoneum.

The kidneys are in a condition of fatty degeneration; the liver is in a state of atrophy and fat; heart normal; lungs affected by emphysema with old adhesions at the apices.

This case, therefore, besides contributing to the statistics of hernias of the cæcum and appendix on the left, may be considered as a specimen of a hernia of this variety without transposition of viscera, and shows how this state of things cannot exist without the mesocæcum and mesocolon being notably lengthened. Whether this lengthening was in this special case acquired or congenital, I think it is not easy to decide; naturally, as a probability, considering the enormous lengthening that was noticed, we must admit a congenital condition rather than it being acquired.

The second case refers to a rare variety of a lateral inguinal hernia. To the history of these hernias, which have also been erroneously called "Littre's hernias," for diverticular hernias must not be confounded with lateral hernias, the following names are to be indissolubly united: Morgagni, 1704; Louis, 1757; Richter, 1799; Scarpa, 1812; Rieke, 1840, who with anatomical descriptions and clinical cases have proved the existence of them. Several other authorities have since written on this subject; they have, however, not only added very little to what the above-mentioned authors had stated, but, in 1857, Roser even denied the existence of them. But this attempt at negation produced the contrary effect, for their existence, thanks to the diligence of surgeons, became not only more and more settled, but

they also had the corroboration of the experiments of Sachs, Kriegl, and Schaeffer, so that now no one doubts that they do exist. It is precisely to a rare variety of these hernias that the following observation refers:

Giuseppina Varotto, aged thirty-nine years, of Brusegana, a country woman, married, relates that a year ago, without any special cause, she noticed the appearance of a swelling on the regio inguino-cruralis on the right, which swelling would increase during bodily strains. A month before the appearance of it she had sustained the incision of a purulent gathering, acutely formed, without the patient knowing how, in the inguinal region.

The apex of the swelling corresponds with the scar left by the former operation; upon bodily strains and fits of provoked cough the swelling appears a little greater, but not very distinctly. Shortly after the appearance of the swelling her repasts had to be very frugal, otherwise she suffered with meteorism. She was, besides, very costive, and was obliged every six or seven days to take some opening medicine by which the pains in her belly ceased, and a swelling of a changeable size, which constantly grew in these circumstances above Poupart's arch, disappeared.

It must be observed that these symptoms, so clear to form a diagnosis, were given one by one by the patient on being repeatedly questioned after the operation, while the history gathered before it only referred to the epoch of the appearance of the illness and on several inconveniences commonly observed in many patients affected with hernia.

On palpation the swelling appears soft, elastic, reducible, and then the finger seems to enter the abdominal cavity; suspending the pressure, the swelling at once reappears.

The diagnosis was of a direct inguinal hernia, acquired, of a small size, containing bowel, reducible; and the operation, according to Bassini's method, was done for its cure.

While introducing a finger below the sac and ligamentum teres, so that by pulling them the incision of the aponeurosis of the external oblique in the direction of the inguinal canal could be easily performed, we penetrate into a cavity which was at once recognized to be that of intestinal lumen.

Having incised the aponeurosis of the external oblique, we

see that the intestinal knuckle adheres directly to the inner surface of the abdominal wall opposite the outer opening of the inguinal canal without any intermediary tissue.

The swelling, which appeared upon bodily strains, derived from the jutting of that part of the coil which corresponded with the outer opening of the inguinal canal, had become so thin as to lose completely the consistency and aspect of the small intestine. The coil adheres all around the opening above described, and having obtained the isolation by dissection, it is clear that lateral enterorrhaphy cannot be performed, the uninjured part of the wall being too limited. We made resection of eight centimetres of intestine, and applied Murphy's button, No. 4. The afferent part has the calibre of the large intestine, the efferent that of the small intestine. Having applied the button, we added for greater safety an extra uninterrupted suture, according to Apolito.

Having reduced the coil, I completed the operation for cure of the hernia after the method of Bassini.

The patient had a complete apyretic course. Defecation began on the third day; on the fourth we gave her liquid food through her mouth, and the nourishing and salt clysters, which had been alternately applied every three hours, were abolished. On the seventh day the stitches were taken away; on the ninth she passed the button; on the twenty-second she left the hospital, completely recovered.

The diagnosis, after the operation, is thus modified: Hernia inguinalis interna or directa, lateral chronic, with symptoms of intermittent strangulation,—a doubly rare variety, as we know the inguinal hernia in women to be generally oblique externa, and the lateral to be hernia obturatoria or cruralis. How can the absence of the sac be accounted for? We know that the sac may be missing in inguinal congenital hernia, in which the peduncle of the sheath, being left open, stands instead of the sac; it may be missing in hernias of the blind gut, which, at least partly, for anatomical reasons, are without a sac, and in those hernias which settle across abdominal scars, in correspondence to which the peritoneum was separated by the contents of the hernia.

In our case the inguinal suppuration seems to have preceded the appearance of the hernia, the apex of which corresponded to the scar. Admitting that the hernia existed before the suppuration, the history has no traumatism to explain the origin of the peritonitis of the hernia, neither can we exclude the possibility of catarrhal lesion of the herniated coil, with emigration of micro-organisms sufficient to have caused suppuration. Nor can we exclude suppuration arising in a cyst of the ligamentum teres, or an acute suppurative adenitis of the inguino-crural region, the etiological relations of which may have passed unobserved by the patient. Of all these hypotheses the latter seems to be the most probable. At all events, whether the hernia existed before and became adherent during the progress of the abscess of the inguinal region, or whether it appeared afterwards, and was formed with laceration of the peritoneum, the absence of the sac can be explained by the suppuration which occurred. Besides having, in this case, an example of inguinal hernia without a sac, we have a specimen of a periodical strangulation every six or seven days.

The strangulation of lateral hernias, which since 1598 seems to have been noticed by Fabricio di Hilden, and which certainly shortly afterwards was minutely described, has been lately denied.

In 1890, Sachs experimentally proved the mechanism of its formation, and any surgeon's experience suffices to state that practically strangulated lateral hernias are found. I operated one of these cases myself last year.

The diminution of calibre in the portion of the coil corresponding with the seat of the hernia must have been chargeable with the enormous augmentation of calibre of the afferent coil, which had assumed the dimensions of a large intestine. The appearance at first suggested that the hernia involved the cæcum at the site of the appendix, in which case the inflammatory phenomena previously observed might have been the consequence of an inflammation of the appendix, the latter having been eliminated through the sac. But,

having well taken away the adhesions and having extracted a portion of the intestine above and below the portion of the site of the hernia, every interpretation, except that of it being a lateral hernia of the small intestine, was untenable. As for the operation, the case presents the following interesting points: That it was possible to apply Murphy's button, No. 4, though the calibre of the two stumps to be anastomosed was notably different, and the result was favorable for the patient.

This interesting and uncommon case of a lateral direct hernia inguinalis, without a sac and adherent, with intermittent symptoms of strangulation, may be a warning to surgeons, since in cases in which symptoms of phlogosis have preceded at the seat of the hernia, alterations, like those I have described, may easily be found.

Being mindful of this possibility, the surgeon should first separate all the adhesions which hold a laterally entangled coil, thus avoiding the opening of it, which would be the *desideratum*.

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## EPITHELIOMATOSIS OF THE BREAST.

By CHARLES GREENE CUMSTON, M.D.,

OF BOSTON,

ASSISTANT PROFESSOR OF SURGICAL PATHOLOGY, TUFTS COLLEGE  
MEDICAL SCHOOL.

UNDER the title of Paget's disease is described a chronic pathologic process, involving the skin of the nipple and the areola, accompanied by a carcinoma in the mammary gland. This affection is, consequently, made up of a pathologic change in the skin and a lesion of the mammary gland. Besnier has given this pathologic complexus the name of epitheliomatosis of the breast, which term we have here adopted as defining the nature of the malady more lucidly.

In 1874, Sir James Paget first gave to the medical world a description of this rather peculiar disease, and again, in 1890, Wickham, of Paris, published his important "*Mémoire*," giving a detailed clinical description of the affection. Wickham emitted the opinion that the dermatitis could go through its entire evolution without any carcinomatous changes taking place in the gland, and, following out Darier's experiments and histologic studies, he concluded in favor of the theory of the presence of psorospermic bodies in the diseased cutaneous structures.

The psorospermic nature of the bodies described by Darier is at the present time denied, and the opinion emitted by Karg is probably correct,—namely, that this dermatitis is epitheliomatous in nature, or at least is susceptible to become so. Schulten believes that epitheliomatosis is a disease similar to carcinoma, but not identical. Jamieson, Russell, and many others have pretty positively proven the non-psorospermic nature of this affection.



The following brief account of a case of epitheliomatosis, which was recently under our care, may, we trust, help to increase our knowledge of this rather rare disease, and afterwards a few general remarks will, perhaps, not be out of place.

The patient, a woman of sixty-two years, and mother of several children, applied at the writer's clinic, at the Tremont Dispensary, in the latter part of November, 1897. She was a stout subject, with an excellent personal history. For the past eight months the patient stated that the nipple of her left breast had been, as she expressed it, inflamed, and had caused great inconvenience from the pruritus to which it gave rise.

Examination of the right breast was negative. The entire areola of the left breast presented a bright-red, moist surface, the process being distinctly limited to the areola. The nipple was not retracted nor deformed. No distinct ulceration could be detected, but in some spots the epidermis appeared eroded. The skin of the breast was normal and no enlarged subcutaneous veins were visible. The surface of the dermatitis gave rise to a rather sticky, slightly yellow secretion.

Directly in the midst of the glandular tissue, and *situated exactly under the region of the areola*, an indolent mass, which appeared by palpation to be distinctly limited to the gland, could be felt, and seemed about the size of a large walnut. Two very hard, small lymphatic glands were detected in the left axilla. The supraclavicular glands were not enlarged. A diagnosis of Paget's disease was made and removal of the breast advised.

On December 12, 1897, we removed the breast and cleaned out the axilla. The patient made an excellent and uninterrupted recovery, and was discharged in three weeks.

We carefully examined the specimen with the following results: Microscopic examination of the neoplasm of the gland showed that in structure it was an ordinary carcinoma.

The epidermis of the areola presented different aspects. In the less diseased parts there was a considerable elongation of the papillæ. The cells of the surface were replaced by polygonal elements, their nuclei being very small. At other points the epidermis was rather thin and the papillæ were absent. Gradually the so-called bodies of Darier were seen in the middle and deep layers of the rete mucosum of Malpighi, and in the spots

where their development was the most marked they penetrated the interpapillary columns.

The cavities present in the epidermis contained *débris* of all kinds, as well as cocci and a few bacilli. In some places the epidermis was quite changed, and small cells of varied shape, with a distinct outline and an opaque nucleus, were seen between the epithelial cells. We consider these elements as in all probability lymphatic in nature.

In the dermis an extremely deep and abundant proliferation of embryonal cells was found in certain parts; their nuclei were granular, and the elements took the stain well. In all the sections examined, the tissue of the neoplasm of the gland was separated from the cutaneous structure by a rather thin layer of connective tissue.

For a moment let us consider the pathology of the disease under consideration. Macroscopically, the epidermis is only slightly increased in thickness, and, generally speaking, the lesion is very superficial. There is no underlying infiltration nor induration. As to the nipple, in those cases in which it has disappeared, either by destruction or retraction, it is replaced by a mass of hard tissue, having the usual appearance of carcinoma.

Microscopically, Darier and Wickham described the bodies that they considered were psorospermic in nature, but which are in reality only a change in the cells. Butlin pointed out that there was a thickening of the layer of cre-nated cells, as well as an increase in the papillæ and subepi-dermic infiltration. Duhring and Weld found the same general changes, and also the presence of cell agglomerations, analogous to the horny globes met with in epithelioma. They found that the dermatitis begins abruptly on the borders, and as the lesion extends from the periphery towards the centre, the areola is deprived of its epithelial covering. They also insist on the vacuolar changes. Unna is also of the opinion that the pathologic changes, making up the so-called psorospermic bodies, are due to a particular kind of degeneration of the prickle-cells, and is a sort of œdema of the epithelium.

The papillæ are infiltrated and round, while on the borders of the interpapillary columns, disseminated, round, or oval, clear spaces are to be seen, and which appear to be of an epitheliomatous nature under a high power. They contain very large nuclei, and are quite rich in chromatin. Many are to be found undergoing mitosis, while in each interpapillary column about one-fourth of the cells present a karyokinesis.

The œdematous cells are distinguished from the others by their nuclei, which are very deeply stained, and are surrounded by a poorly stained, protoplasmic areola. Sometimes the œdematous cells are disseminated uniformly throughout, and the rete mucosum of Malpighi is tumefied. The lacunæ are differentiated from the intercellular vesicles by the fact that there are no dilated plasmatic spaces, but a real loss of substance is present, resulting from an intense liquefaction of the cell protoplasm.

Unna differentiates the lesion in question from a reticulated degeneration of the epidermis by the fact that the uniting filaments have entirely disappeared, while their traces are present in the latter lesion.

Karg states that he has distinctly seen the diseased epithelium pass through the basement layer and extend throughout the dermis in a most atypical manner, so that the epidermic degeneration always ended in a carcinomatous formation.

Banti has described Darier's bodies carefully, as well as the capsules, intracapsular bodies, and the endogenic formation of the latter. He believes in the psorospermic nature of the bodies, but does not consider them as parasitic. Neisser and Barduzzi accept the psorospermic theory, while Ravolgi states that the dermatitis is not, in the beginning, a true epithelioma, but that later on it may become carcinomatous.

Briefly, then, the lesions met with are as follows: On the very thickened borders of the epidermis, Darier's bodies are present. When they are typical, these figures are apparently a sort of rounded cyst, clear at their periphery, with

their limiting membrane, occasionally presenting flattened nuclei, and containing or rather including another cell with its protoplasm and nucleus. The protoplasm is only slightly stained, while the nucleus, which is always large and well stained, shows signs of karyokinesis.

Towards the centre of the lesion these bodies are more numerous, and at last completely obstruct the interpapillary spaces. The entire epithelium is then composed of pseudo-cystic cells, which are completely wanting in uniting filaments. These changes are quite as marked at the basal membrane, near the generative layer, as in the midst of the interpapillary columns.

During all this process, all keratogenic evolution has entirely disappeared. A kind of fibrinous exudate is immediately superposed on the rete mucosum of Malpighi, and at last the exudate disappears, the epidermis undergoes a complete abrasion, and is only represented by the decapitated trunks of the interpapillary columns. Below, the reactional infiltration is both limited and intense, and is seen as a closely packed accumulation of plasmatic cells.

At certain points the diseased epithelium undergoes most important changes. The papillæ become elongated, deformed, and present a bifurcation; the basement membrane, being broken through by the vacuolated epithelium, sets up a perfectly distinct carcinomatous infiltration. The stroma is fibrous, while the alveolæ are filled with polygonal epithelial cells, with an oval nucleus and rather poorly off in chromatin. Many of them are undergoing karyokinesis. The cells are uniformly filled with a granular protoplasm.

In the deep structures most observers have found an obstruction of the excretory glands, but this is not invariably the case. Although the carcinoma of the gland may resemble a glandular epithelioma, many specimens only show inflammatory changes in the canals of the gland, while among them may be seen disseminated neoplastic alveolæ.

As Fisse has pointed out, epitheliomatosis of the breast is an acantholytic process from the onset, and commences in

both the deep and middle layers of the epidermis, firstly by the disappearance of the uniting filaments and a pronounced tumefaction of one or several cells. Their protoplasm becomes contracted and disappears, while in their interior other cells are seen, probably born by an endogenic process of division.

The acantholysis and cell tumefaction finally invade the entire epidermis, and under the influence of this lesion the epidermis loses all power of accomplishing a keratogenic evolution; it is thus without protection, and consequently undergoes a partial destruction.

In some cases the altered epithelium takes on the properties of a malignant tissue, breaking into the dermis and invading the latter in the form of a carcinomatous infiltration, the alveolæ of which are filled with cells having a cutaneous origin.

As to the manner in which the pseudocystic formations take place, Fisse says that an initial change of a ferment type may occur in the exoplasma of Malpighi's cells. The exoplasma loses its uniting filaments and becomes of such consistency that it forms a true enveloping membrane. Then the protoplasm condenses around the nucleus, and as the latter has not lost its power of multiplication, when the mass of protoplasm is ready to divide it cannot break the exoplastic membrane of the mother cell any more than can the daughter plaque. In other words, a process of granulation takes place within, because the elements of the granulation tissue are incarcerated, on account of the change in the maternal exoplasma.

Epitheliomatosis of the breast is not an infrequent affection, and, according to the cases recorded thus far, may occur between the ages of twenty-two and seventy-two years. The disease has been met with in the male breast, and in a case reported by Crocker the scrotum and penis were also the seat of the malady. Other parts of the body have been attacked by it.

The affection rarely attacks both breasts, but Besnier has

pointed out that when only one breast was diseased the other nipple (the healthy one) often presents keratogenic productions. The latter may be due to want of cleanliness, in which case these productions would appear to be an etiological factor and not an early symptom of the affection.

So long as the epidermis of the areola has its keratinized covering, the disease may be considered as at its *début*, and it is not at all certain that every female who presents adherent and persistent scabs covering the areola will, of necessity, develop an epitheliomatosis. It is well known that the period of latency may last for many years, but there are instances in which it extended over only a few months.

The affection manifests itself by an excoriation of the integument, be it traumatic or otherwise. There is not a tendency for the nipple to retract at an early date, and in the case here reported, and in another recorded by Fisse, the nipple was not retracted, even although the gland was well invaded by the carcinoma.

When the initial point becomes definitely excoriated, and the parts covered by scabs become red and present a moist surface, completely deprived of all keratinization, it may be said that the affection has developed, but, generally speaking, there is no true ulceration present.

The disease once under way, occupies the entire areola and nipple, the parts being limited by normal skin. The lesion only infrequently extends beyond the areola, but some instances are on record in which it extended eccentrically over the greater part of the breast or even the thorax and arm. There is only a very slight induration of the patch, probably because the integument only is affected, there being only a slight involvement of the subepithelial connective tissue.

The most frequent subjective symptoms are pruritus, pain, more especially during lactation, dragging or burning sensation, etc.

As is well known, when epitheliomatosis occurs in the breast, the presence of a carcinoma in the latter is most sure

to appear sooner or later. The neoplasm develops in various forms, sometimes as scirrhus, with several foci scattered through the tissues of the gland; at others, it takes the form of an ordinary carcinoma. In most instances the carcinoma is quite independent from the dermatitis, but the neoplasm may extend towards the surface and invade the diseased epidermis from below. When this occurs we have a true carcinomatous ulceration, which interrupts the continuity of the diseased integument. The ulcerations usually start at the orifices of the galactophores and infrequently an ulcerating epitheliomatosis may arise on the surface.

The carcinoma is not typical in each and every case, and Fisse reports one example in which there was undoubted adenomatous formation, the adenoma being reproduced in an accessory breast in the axilla. The symptoms are those of ordinary carcinoma of the breast with infection of the lymphatic glands of the axilla and pectoralis major, when the case has advanced.

Epitheliomatosis would in all probability continue indefinitely if the carcinoma did not appear. Pregnancy and lactation, as might be expected, appear to increase the rapidity of its progress, and when the carcinomatous formation arises in a young subject, it takes on its usual excessive malignant characters. In elderly people the neoplasm is usually of the atrophic scirrhus type.

In considering the prognosis, we should make two distinct types of the affection. Among the first are those instances in which the malignant transformation has not as yet appeared, and it is evident that the prognosis, although reserved, is favorable, if by proper treatment the lesion of the areola can be perhaps cured.

When the patient presents a malignant transformation in the gland, the prognosis is that of carcinoma in general, and is naturally graver in direct relation to the length of time the neoplasm has been present and in indirect relation to the age of the subject.

A differential diagnosis of epitheliomatosis of the breast

is not difficult to make, but when it is localized to the nipple, it may be mistaken for an eczema, especially the seborrhœic form. In the latter type the scabs are yellower, more greasy, and less adherent, while the prognosis is perfectly benign.

A syphilitic initial sclerosis of the superficial type might be mistaken for an epitheliomatosis of the breast, especially when the latter is in its early stage, and consequently limited in extent, but the initial sore will rarely involve the entire nipple; it is always accompanied by an induration, and its surface is less papillomatous than in Paget's disease. The appearance of secondary lesions will soon disperse all doubt as to the nature of the local lesion.

As to treatment, we believe, contrary to the opinion of Mr. Roger Williams and some other authorities, that every time the diagnosis of epitheliomatosis of the breast is made with certainty, removal of the breast should be done without delay, and we agree with Mr. Sheild when he says that it is probable that excision of the nipple and areola or nipple alone, without removal of the breast, is not sufficient to insure the patient against the later appearance of mammary carcinoma. We can, it is true, cure the lesions of the areola and nipple by medical treatment in many cases, but the danger of malignant transformation in the gland would lead the writer to amputate the breast in every case, and we strongly protest against the treatment of this affection by the dermatologist.

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## VENEREAL ARTHROPATHIES.<sup>1</sup>

By STEWART LEROY McCURDY, M.D.,

OF PITTSBURG, PA.,

PROFESSOR OF ANATOMY AND SURGERY, PITTSBURG DENTAL COLLEGE.

GONORRHŒA and syphilis are unquestionably important factors in the production of diseases of bones and joints, gonorrhœa producing a majority of cases of synovitis of adults, and syphilis causing a greater portion of epiphysitis, or the so-called tubercular bone-disease, of adults, while there is no doubt that many of the other varieties of chronic bone-disease, as Pott's disease and hip-joint disease, now classed as tubercular, are due to inherited syphilis.

These diseases will be presented under three heads:

- (1) Those resulting from gonorrhœal infection.
- (2) Those appearing during the course of acquired syphilis.
- (3) So-called tubercular bone- and joint-diseases, of children, which have hereditary syphilis as an associated causative factor.

*Gonorrhœal Synovitis.*—Statistics show that 2 per cent. of all cases of gonorrhœal arthritis have as a sequel some form of arthritis. König believes that 90 per cent. of all cases of synovitis of adults are associated with urethritis, and concludes that gonorrhœal arthritis is the most frequent variety of synovitis.

Women and men are equally affected, but König states that many cases of puerperal arthritis, as well as of chronic articular rheumatism in women, are gonorrhœal.

Usually but one joint is involved, but occasionally many

<sup>1</sup> Read before the American Orthopædic Association, June, 1898.

joints are successively involved when the case is one of polyarthritis purulenta, or pyæmia. The knee is the most frequent seat of the disease in men, and the wrist in women.

The varieties of gonorrhœal joint-disease are grouped by König as follows:

- (1) Where simple effusion alone occurs.
- (2) With fibrin-formation and capsular thickening.
- (3) The latter condition associated with periarticular phlegmons with involvement of the tendons and ligaments.
- (4) A condition in which ankylosis occurs very early, with the deposition of much fibrin and infiltration of the ligaments. In all of these cases there is great tendency for the ends of the bones to grow together.

The *bacteriological* origin of all cases of synovitis of adults can hardly be questioned. Nasse, of Berlin, made cultures of the secretions in thirty cases of suspected gonorrhœal synovitis, and found gonococci in nineteen, and Bordoni-Uffreduzzi reports a case of gonorrhœa complicated by polyarthritis, in which the pus removed from a joint was found to contain gonococci. This writer inoculated the urethra of a subject with a culture taken from the second generation of these gonococci, and succeeded in producing a gonorrhœa. Dr. König, of Berlin, advises that in any case of acute inflammation of the joint an examination and culture of the urethral discharge should be made. Jundell describes the first case of blennorrhagic tendo-synovitis in which the diagnosis has been positively confirmed not only by recognition of the gonococcus, but by its actual cultivation. The tendo-synovitis was located in the sac of the posterior tibial muscle. The gonococci were found in, and cultured from, not only the pus, but also the granulation tissue from a cavity ten centimetres long. The gonococci were after culture injected into the urethra of a moribund male and recultivated from the specific urethritis produced thereby.

The relation of the gonococcus to synovitis presenting the clinical characteristics of blennorrhagic arthritis is considered by Respighi and Burci as indubitable, its presence

being demonstrated by preparations and cultures. The gonococci are localized superficially in the synovia, and tend to disappear rapidly by involution; but the process continues by evolution of the pathological alterations which it has caused on the surface of the serous membranes, and the products of its destruction may remain active. The absence of the gonococcus, often noted, may be explained either by the time at which it was sought for or by the fact that it was limited by the free exudate.

The symptoms are similar to other varieties of synovitis, except that the course is more active and associated with chills, high fever, and rapid emaciation. The urethral discharge stops during the active joint-disease. A chronic course is run in some cases, when it is most frequently a sequel of gleet. In the acute variety the liquid in the joint accumulates rapidly, and is of a serous nature, containing fibrin, blood-corpuscles, and pus-cells in abundance.

Roswell Park reports a case of acute gonorrhœa in which the discharge ceased after about two weeks, to be followed shortly by swollen knees, sepsis, a typhoid condition, and death. At the autopsy pus was found in the sterno-clavicular articulation with erosion of bone, pus in other joints, enlarged mesenteric glands, etc. This appears to be the first case of its kind on record. Dr. Park was not certain that it was the patient's first attack of gonorrhœa, and was not acquainted with the condition of the deep urethra before the attack.

Klippel, in reporting two cases of the nature affecting the sterno-clavicular articulation, calls attention to the fact that the associated muscular atrophy was of the pectoralis major. Cheminade finds that while ordinary blennorrhagic arthritis is very rare in women, it is unattended with fever, the general symptoms are not well marked, and the knee is generally the joint affected. Yet there is occasionally met with, in women, an arthritis of such origin in which the general symptoms are severe, the fever high, and the wrist and elbow the ordinary seats.

The treatment for all of these varieties of gonorrhœal joint affections is early aspiration and irrigation of the joint cavity with bichloride solutions followed by an injection of iodoform emulsion, which is allowed to remain in the joint. If, after a few treatments of this kind, fever does not disappear and local symptoms do not improve, an arthrotomy should be done, and the operator should have no hesitation in freely opening the joint where there is much pain and other symptoms, since the longer these cases are permitted to go without operative interference the more likely there is to be ankylosis. If the operation is successful, the pain should rapidly disappear, the temperature fall, and the general condition improve. Early operation will prevent rather than increase the danger of ankylosis. If the surgeon is satisfied that the joint surfaces have been destroyed, the member should be placed in a normal position and immobilized with plaster of Paris. Lassalle strongly advocates arthrotomy in all forms of blennorrhagic arthritis, and states that the method is especially applicable where there is much pain and distention.

Since ankylosis is almost invariably the result, an effort at *brisement forcé* before all symptoms have subsided is usually practised, but it is likely to be followed by a renewed attack.

The following cases are reported to more thoroughly elucidate this grave and most troublesome complication:

CASE I.—J. T., aged thirty-five years, was attacked with acute synovitis of the right knee-joint about three weeks after he had contracted a gonorrhœa, which followed dissipation and exposure. The joint was greatly distended, redness and swelling about the joint marked, pain very severe, elevation of temperature, frequent pulse, and loss of appetite; emaciation and atrophy of the muscle of the thigh and leg rapidly succeeded. The knee-joint was aspirated and about six ounces of synovia, mixed with pus-cells and shreds of fibrin, were removed. This was followed by irrigation of the joint with solution of bichloride. Local application was made to the joint of a solution of equal parts of glycerin, tincture of iodine, laudanum, and fluid extract

of belladonna, applied on a sponge and held in position by oiled silk and a bandage. Buck's extension was applied until an elastic traction-brace was made and applied, after which symptoms began to abate. During the course of the inflammatory process it was necessary to aspirate the joint five times, which was always followed by an injection. The case made a complete recovery in three months. It was followed by limited motion, but no bony ankylosis.

CASE II.—A., aged forty-three years, a farmer, had an attack of malarial fever (?), which lasted about ten days. He made a good recovery; but the first day he was out he walked quite a distance, and the second day he over-exerted himself, and was caught in a rainstorm, and thoroughly drenched. He again went to bed with symptoms of relapse of his malarial fever, but after he was in bed three or four days, his right knee became painful and swollen. This condition became rapidly worse until a typical synovitis of the right knee-joint developed. For some days after the trouble began the pain was unendurable, except under morphine. An effort was made to treat the trouble by use of liniments, etc., but both the pain and distention of the joint increased. An extension-brace was applied, and the pain was to a great extent relieved. This patient was very intelligent, and used the elastics perfectly, and was able to so adjust the traction as to secure wonderful relief. Upon two or three different occasions the patient thought he would do away with the traction, but he was glad enough to reapply it because of the great relief it afforded him. This case was aspirated eighteen times, and thirty ounces of pus removed from the synovial cavity. Ten injections of a solution of 10 per cent. iodoformized glycerine were made into and around the joint during the course of the trouble. The symptoms for a time were grave, and the high fever and extreme emaciation made it a serious question as to the advisability of an open operation; but the patient began to show some signs of improvement, and in three months after the onset of the trouble the active symptoms had subsided, and the brace was laid aside for a plaster-of-Paris splint. He discarded the plaster of Paris, and in two months the knee was practically well. The patient had an acute specific urethritis at the time of the onset of the trouble; the discharge ceased, however, during

the synovitis, but returned as a gleet after the knee symptoms had subsided.

CASE III.—L. H., aged thirty years; railroad fireman; acute synovitis of the wrist-joint, associated with specific urethritis. The case was very severe, associated with all of the symptoms of acute disease,—viz., pain, swelling, slight redness, doughy condition of the soft parts with atrophy of the muscles of the forearm, temperature, and marked emaciation. Under aspiration, irrigation, injection of iodoform emulsion, with elastic traction, the patient made a very good recovery with slight ankylosis, after being off duty for five months. He is now pursuing his former occupation.

CASE IV.—V. D. P., aged twenty-six years, railroad conductor, sprained his ankle by getting off his train, which was followed by a very active synovitis of this joint with the usual symptoms. It was learned at this time that he had had gonorrhœa, but the discharge ceased at the beginning of the synovitis. Patient was given internal treatment of iodide and mercury, with local applications of stimulating liniments, with elastic traction, but no operation was performed. After a course of about six months he was able to be about and return to work.

*Syphilitic* lesions of bones, either hereditary or acquired, make up a greater portion of all joint- and bone-diseases. So-called tubercular diseases of children are frequently manifestations of inherited syphilis. This statement is verified by the rapid progress made towards recovery in cases under anti-syphilitic treatment, and the marked destruction of bone and other tissues when mechanical treatment alone is depended upon. Cases of every symptom of hip- and Pott's disease have disappeared without deformity in a few months under vigorous medical treatment, along with mechanical measures.

Syphilitic epiphysitis of adults, occurring during or subsequent to an initial lesion, has been considered by Fournier under the following heads:

(1) Arthralgia, or articular pains, without appreciable changes; (2) subacute arthritis resembling somewhat a mild form of rheumatism; (3) hydrarthrosis.

(1) *Arthralgia*.—This is characterized by pain on mov-

ing the joints, although there is no appreciable change. It is simply a functional trouble, and is found in almost all joints, more especially the scapulo-humeral articulation, and the knee; next in frequency the elbow, the wrist-joint, and the tibio-tarsal articulation, and less commonly in the joints of the hands and feet, the temporo-maxillary articulation and the hip-joint. One characteristic of this affection is that the pain is severer when the joint is at rest than when in action, and is rather more frequently met with in women than in men. It commences at the beginning of the secondary period, and is coincident with the macular syphilide and the general nervous and febrile disturbance. Its duration is variable, frequently disappearing spontaneously; but in many instances it may persist for several months in untreated cases. It readily and quickly yields to mercurial treatment.

(2) *Subacute Arthritis*.—This is the rarest form. It is attended by great pain and disturbance of motion and the joints are slightly swollen. Sometimes even a slight exudation may occur in the joint, which may readily pass undetected. Usually one joint is affected, sometimes two, and rarely three. Almost subacute in character, it runs a febrile course. The knee is the joint which is especially attacked, the elbow, wrist-joint, and tibio-tarsal articulation less so. It is not observed in the small joints.

(3) *Hydrarthrosis*.—This is more frequent than the subacute variety, and is distinguished from it by having less pain, by a greater exudation into the joint, which, however, is never very large, and by the fact that it is never attended by fever. The seat of the affection is almost exclusively the knee-joint. The subacute form and the hydrarthrosis may leave permanent changes behind, as indicated by a grating sound on moving the joint. The duration, if left untreated, is long; but if treated, it can be cut short. These lesions so closely resemble rheumatic affections that they are oftentimes regarded as simple rheumatic pains developed in syphilitic subjects.

Hutchinson, of London, makes the following division



of the affections: (1) Synovitis during the secondary stage, which usually occurs within a few months of infection, is of but short duration, is very amenable to mercurial treatment, and clears off, leaving no trace behind. It is rare and of far less importance than the other forms, which all occur during the tertiary stage. (2) Perisynovial gummata. (3) Arthritis due to osseous nodes or gummata in the neighborhood of the joint. (4) True chronic synovitis. (5) Syphilitic chondro-arthritis (Virchow).

In the second stage or form, effusions into the bursæ or tendon sheaths are occasionally met with. Perisynovial gummata are more common in women than men, the tissue around the knee being particularly liable to be affected. It is a frequent and very chronic form. The third form is really comparatively rare, in spite of the fact that some authors incline to place all forms of syphilitic joint-disease under this head. These osseous nodes have one diagnostic symptom,—viz., severe nocturnal pains. The fourth form is the common form of syphilitic arthritis. To the above (5) forms the author adds two others, as occurring in hereditary syphilis; (6) syphilitic epiphysitis, and (7) chronic effusion into joints, usually the knee, and almost always associated with interstitial keratitis.

Rasch states that the particular form of syphilitic disease, known under the name of specific chondritis or chronic hypertrophic syphilitic arthritism, is characterized partly by a circumscribed ulceration and fibrillar breaking up of the cartilage, with the formation of villous outgrowths, partly by the presence of radiating, depressed cicatrices placed in the cartilage, and partly by a diffused thickening of the synovial membrane and a marked proliferation. The lesions seem always to invade both the synovial membrane and the cartilage. The ulceration of the cartilage depends upon gummatous infiltration. The clinical features of a case of syphilitic chondro-arthritis are said to be, diffuse, soft swelling of the synovia, with slight limitation of movement; pain, which



is present to a limited degree, and is not aggravated by motion. They are evidently not distinctive.

Duguet presented a case of periostitis of the temporal bone, accompanied by myositis of the temporal and masseter muscles, apparently of syphilitic origin. Fournier, commenting on this case, states that he has observed only four or five similar ones.

Feulard presented a patient who suffered for two years from an enormous gummatous tumor of the left thigh. This enlargement was mistaken for one of malignant nature, and an amputation was proposed. It was later suspected that it might be syphilitic. Constitutional treatment was instituted, and was followed by speedy cure.

Among those who have written on this subject are Cheminade, Rubenstein, and Trinkler. Rubenstein publishes statistics of forty-three cases treated in Schuller's clinic,—one from secondary syphilis, twenty-six tertiary, and sixteen hereditary,—in children from three to sixteen years of age. In eighteen months Schuller saw 328 cases of joint inflammation, of which  $6\frac{1}{2}$  per cent. were syphilitic in origin. The capsule in syphilitic inflammation of joints often becomes hardened in spots, and lacks the uniform, doughy feel of tuberculosis. He also emphasizes the nocturnal pains in syphilis.

According to Lannelongue, the diagnosis from tubercular disease is to be made by observation of the facts that there is no involvement of the joint itself, and that the swelling affects the bone in its immediate vicinity; that there is an absence of muscular contractures limiting the movements of the joint; that the enlargement of the bone is diffused and general, and that there are present other evidences of syphilis.

*Gummatous ostitis*, or syphilitic diseases of joints and bones, is characterized by the formation of gumma in the epiphysis or synovial membrane and the periarticular structures or shaft of bone. It must be differentiated from tubercular disease. There is an absence of hyperæmia; the tumefaction of the joint is spongy or elastic. Fatty degeneration

of tissues occur with an involvement of all structures about the joint. Purulent synovitis is developed in a portion of cases. The destruction may be so extensive as to destroy the epiphysis and cause it to separate.

*Heredity* as a factor in the production of disease is well known, and Dr. Gibney states that 499 out of 500 cases of hip-disease give a history of tuberculosis in the immediate ancestry. Statistics do not, however, show how many of these afflicted children had syphilitic ancestry. The saying of the late Dr. Gross is well known, who concluded that the children of almost all soldiers of the rebellion had inherited syphilis. Railroaders, river-men, and seamen, and men of all pursuits which require them to be away from home, too frequently have syphilis. Indeed, I know that syphilis is most common among all these classes, and the limit is not here, but it extends to miners, mill-workers, and clerks, and merchants, and retired citizens are too frequently the victims of later syphilitic manifestations. If these statements are correct,—and I hope they are not,—do you think it would be a difficult matter to find a history of syphilis in every case of Pott's, hip-, or knee-joint disease? Without definite data upon which to base a claim beyond that of personal experience, and that is insufficient, no claim will be made. It is the desire of the paper, however, to call attention to this apparently neglected element as a cause of these diseases, and ask the members to give their patients the benefit of medical treatment. The mechanic thinks of his brace, the operator of his Volkmann spoon, and the general practitioner neglects the instrument-maker for his medicaments. Treatment is only perfect, however, when there is a co-operation of the quartette.

The following cases are recorded as evidence:

CASE V.—Annie G., aged three and a half years, was confined to her bed, and had been unable to walk for about five weeks on account of paresis of the lower extremities, associated with dorso-lumbar Pott's disease. A plaster-of-Paris jacket was adjusted, and in one week she was running about the house. In

two months the case developed a psoas abscess which presented itself below Poupart's ligament. In fifteen months after treatment was instituted the abscess had entirely disappeared, excepting slight induration of the psoas muscle, deep down in the pelvis. The abscess received the usual treatment of aristol and lanolin ointment.

The deformity is now practically nothing, and the case is wearing a light retaining brace. Here, as in the former cases, *syrupus trifolium compound*, or iodide of iron, was given continuously.

CASE VI.—Bessie K., aged five years, came under observation in the first stage of lumbar Pott's disease, with very slight knuckling of the spinous process of the first lumbar vertebra. Spine rigid; patient in fair health. The patient was limping considerably, the right thigh was adducted, flexed, and rotated inward. So marked was this that an inspection would lead to a diagnosis of hip-disease, as the attendant had insisted. In this case there was limited motion of the hip, but not rigidity. I was able to exclude hip-disease, and decided that the hip symptom was due to the existence of an abscess burrowing along the psoas muscle. This proved to be correct, as the abscess two months later presented itself in the pelvis above Poupart's ligament, which did not elevate the skin at this point above the normal line more than an inch. Under the ointment and massage treatment it disappeared. This case had worn an adjustable plaster-of-Paris jacket, day and night. The hip symptom disappeared, and no hip-disease exists beyond the abscess in the sheath of the psoas muscle, which limited the range of motion in the joint. Iodide of potassium, in some form, was used throughout the entire course of treatment, and in one year the case was well.

CASE VII.—J., aged six years, showing characteristic limp, limitation of motion, night cries, slight flexion, adduction, and marked inversion of the foot, without fever or constitutional disturbances. A hip-brace, as used by the author, was ordered and adjusted, and was worn for five months, when the symptoms had so much improved that the short brace, as used by Sayre, was applied, the larger one having been removed. The short brace was worn for another six months, when it was removed and the patient discharged. All symptoms had disappeared except a slight limp, due to the restriction to locomotion, as a re-

sult of the continued use of the brace, which disappeared in a couple of months, when the patient walked without limp. There was reason to believe that the child had inherited a specific taint and she was given, very faithfully, *syrupus trifolium* compound throughout the entire course of treatment, and to this must be attributed the prompt recovery.

In conclusion, it would appear (1) that many of the cases of acute synovitis of adults are gonorrhœal, and should have aspiration, irrigation, and iodoform, or arthrotomy.

(2) That many of the cases of epiphysitis of adults are associated with secondary syphilis, and should have proto-iodide of mercury; and with tertiary syphilis, should have iodide of potassium, and in neither condition should a knife be used.

(3) That many of the cases of hip-joint and Pott's disease, and other bone-diseases of children, are suffering with hereditary syphilis, and should be given the iodides.

(4) That in all cases of the so-called bone- and joint-disease iodide of potassium should be given, whether a specific history can be obtained or not.

## A METHOD FOR FACILITATING ENUCLEATION OF TUMORS OF THE THYROID GLAND.

By BERTHOLD ERNST HADRA, M.D.,

OF SAN ANTONIO, TEXAS.

IN the *Centralblatt für Chirurgie*, 1898, No. 18, von Manteuffel, of Dorpat, describes a method of resection for parenchymatous goitre very similar to one described by myself, and published in 1895 in the *Texas Medical Journal*, No. 1. I do not entertain the faintest idea that this distinguished surgeon was aware of my communication.

The subject, no doubt, is of sufficient importance to command attention and investigation. Von Manteuffel's observation is as follows:

"I consider the procedure worthy of publication, because it allows to exsect pieces of the tumor at will, with very small loss of blood, and does not necessitate ligatures *en masse*. I use Kocher's crescentic incision in bilateral, and a longitudinal one along the inner border of the sterno-cleido-mastoideus muscle in unilateral goitre. Then the deep fascia is incised and the tumor exposed, and made to rise in its capsule. The soft tissues on the sides are pushed away, affording ready access to the base of the gland. If the isthmus is very wide and contains large vessels, or if it compresses the trachea, I divide between two ligatures. The assistant grasps the superior thyroid vessels with the thumb and index-finger of his right hand, and the inferior vessels with the same fingers of his left, and compresses firmly. The operator can now safely make sections of the tumor, like cutting a melon, without danger of hæmorrhage, provided the posterior wall of the capsule is not too closely encroached upon or perforated. In the latter event hæmorrhage and injury to the recurrent nerve may occur. A running suture through the parenchyma closes the incision, the needle passing through the deepest

part of the wound. I use silk, have also used catgut. Ligatures are not required, unless some vessels of the capsule require them. It is important to leave a sufficient amount of tissue, especially in bilateral goitre, in order to guard against cachexia. Vascular parenchymatous goitre has also been successfully treated by this method.

"The operation is quickly performed."

I will now quote the description of my operation published in the *Texas Medical Journal*.

"In an unilateral or medial tumor, a long median incision from the jaw to the sternum is made; in a bilateral case, Kocher's crescentic incision from one sterno-cleido-mastoid muscle to the other, the highest convexity close to the sternum, is preferable on account of its least disfiguring scar. Then the platysma is divided in the same line.

"Next the muscles are separated in the median line, drawn to the sides, and only when necessary nicked or severed, to be afterwards reunited. Now the most important point to facilitate the operation is to free the tumor of that fine capsule, containing muscular strata, which binds the organ down. This membrane has to be well divided, and to be broken all over by detaching it from the gland, sideways and downward. Then, and only then, the gland or the tumor can easily be brought, with all its processes, into the field of operation by the operator's fingers. This manœuvre never must be omitted, or one will have to work in the depth and in the dark. Now, I take the diseased raised portion of the gland, as much as conveniently can be grasped, at its deepest point, between the index-finger and thumb of my left hand, compressing in this way the blood-vessels from below, and then the incisions are made in the direction where the large veins can be best avoided. The incisions have to go through the whole affected portion down to your left-hand fingers, and have to be repeated until all the nests of colloid accumulations are exposed. They then are well scooped and scraped out with a sharp spoon, and with the compressing fingers still controlling hæmorrhage, the remaining walls, which consist of healthy parenchyma (pared, if they seem to be too massive) are brought together with a running catgut suture

until they are drawn well together into one mass. This last part is best done by the assistant, so as to let the operator keep his hold on the blood-vessels. Of course, this procedure has to be repeated on other portions, if necessary. The wound is then closed with any material the surgeon prefers, and with or without drainage. I would warn against using silk for the deep sutures. It may not remain dormant, but cause fistulous tracts, as has happened to me once, necessitating the reopening of the wound to remove the foreign body. I would add that almost always a moderate fever followed my operations, which was, no doubt, an absorption fever, and should not cause any alarm."

It is seen from the above that I have had in view mostly colloid goitre. The technique will not materially differ for other varieties. Our methods have in common the following three important features: (1) Temporary compression with fingers; (2) exsection or scooping out of diseased tissue; (3) closing the wound by a running suture while compression is maintained.

The differences are more in practical details. I hold that the splitting and detaching of the capsule is the greatest aid to an easy exsection of the gland. The capsule binds down the struma by fine muscular fibres, radiating upward and downward. As soon as they are severed the struma will bulge forward. In Zoega's method, the gland, not being disengaged, remains far down at the bottom of the wound. The capsule in some subjects, it is true, is very thin and not easily recognized. In others it is rich in blood-vessels and adherent. With due caution, though, it can be nicked and then carefully detached, and its vessels, if necessary, doubly secured before division. To my recollection, Kocher and other surgeons called attention to this point long ago.

Another point of difference is in the removal of the diseased tissue. Zoega slices out spherical sections, I scoop out the diseased tissue. It is readily understood that his method is more adapted to parenchymatous, while mine is to colloid goitre. Modifications, though, may be left to the judgment of the operator. I would also warn against allow-

ing any colloid nests to remain, as they are liable to grow. Such has been my experience in one instance. On the other hand, the diseased tissue, in parenchymatous goitre, left behind will most likely atrophy, as experience teaches. Finally, I think the operator will best make compression and suturing himself, which can easily be done with a good assistant who quickly hands instruments, and tightens the first knot of the running suture. The operator will thereby have control of the field and will more safely guide the needle around the wound. The choice of the fingers, whether the thumb and index, or second and third fingers for compression, will depend upon his adroitness.



A CASE OF APPARENTLY HOPELESS INFILTRATION OF LEFT AXILLA AND SCAPULA BY ROUND-CELLED SARCOMA; EXTIRPATION ATTEMPTED AND ABANDONED; EXTENSIVE AND SEVERE WOUND INFECTION FOLLOWED BY DISAPPEARANCE OF THE TUMOR.<sup>1</sup>

By MAURICE H. RICHARDSON, M.D.,

OF BOSTON,

SURGEON TO THE MASSACHUSETTS GENERAL HOSPITAL.

THE following case seems of interest in connection with the subject of the disappearance of malignant tumors under the influence of a general toxæmia, whether artificially or accidentally produced. The occasional cure of malignant disease by internal medication excites not only interest but incredulity. Incredulity is natural enough in view of the rarity of so fortunate a sequel; but it assumes error in observation on the part of the surgeon and error in diagnosis on the part of the pathologist. It may dismiss as valueless what many regard as evidence of the greatest importance,—the history and gross appearances of the tumor. Scepticism may be so extreme that carefully observed cases are thrown out, for one reason or another, though I cannot but think chiefly for the reason that they were successful.

As an illustrative example I would cite one of the most extraordinary cures of sarcoma that I have ever seen. In this case Dr. Garland and myself, at the time of operation, made the diagnosis of hopeless malignant disease of the abdominal wall. Dr. Whitney made a careful microscopic ex-

<sup>1</sup> Presented to the American Surgical Association, April, 1898.

amination of the tumor and reported it to be a fibrosarcoma. After some months' treatment by Coley, the tumor, though as large as a child's head, disappeared,—not only did the tumor disappear, but there resulted in the two-inch scar of the exploratory cut a ventral hernia, although the incision was made in an abdominal wall infiltrated to the thickness of at least six inches.

Not that one is to be blamed for incredulity,—such a recovery excites it to the greatest degree; but if we are incredulous we must abandon as worthless that evidence upon which we are accustomed to base the character of new growths. For example, some years ago I examined a man of thirty, a farmer, who had been operated upon April 30, 1892, by Dr. Powell, of New York, for tumor of the bladder. Soon after the operation, which had been successful, the tumor reappeared. On October 11, 1892, I examined the patient, and found a large tumor of the bladder, involving the prostate. The case seemed absolutely hopeless. There was a median scar between the umbilicus and the pubes, the abdominal wall was somewhat retracted, and in the pelvic region was pushed forward by several smooth, elastic, rounded masses. Dr. Powell wrote me, January 10, 1894, that it was one of the largest bladder tumors ever seen at the hospital; that all who saw it agreed that it was malignant, and that the diagnosis was sustained by the report from the laboratory. The microscopic diagnosis was carcinoma. In January, 1894, I was informed by a brother-in-law of this patient that Mr. B. had been cured by a "cancer doctor." I saw the brother-in-law August 4, 1898, and was told by him that Mr. B. was "perfectly well." A permanent recovery, after unmistakable recurrence of a carcinoma of the bladder, is certainly extraordinary. The lacking testimony is the present physical examination, which I have not had the opportunity of making. That the man is apparently well, six years after the recurrence of a carcinoma of the bladder, cannot be denied.

If a cure by means other than surgical is, from the very

fact of cure, declared sufficient proof of a mistaken diagnosis, there seems little use in presenting evidence. I am convinced, however, that a considerable number of tumors, pronounced malignant, and in fact malignant, disappear under local or systemic conditions which are artificially produced. The curative influence of micro-organisms upon malignant growths, whether during the course of an accidental wound-infection or under the influence of a deliberate toxine injection, is a hopeful indication of far-reaching possibilities of good.

The following case has been under the observation of Dr. R. H. Fitz and myself since 1892. In the beginning it was pronounced a malignant lymphoma, and some fifteen affected glands were removed by myself. Dr. Beach removed a single tumor later. In 1896 I operated for an extensive tumor, which had involved the left axilla, the left scapula, and the skin over it.

The history which follows is abstracted from the records of the Massachusetts General Hospital, Vol. cclxxiv, p. 288.

John R., aged four years, of good family history, entered the Massachusetts General Hospital October 6, 1892. He had always been well until six months before entrance, when lumps appeared in the left side of the neck, and rapidly increased in size. There were no other symptoms. Examination showed a well-nourished boy. On the left side of the neck were numerous enlarged glands. They were movable, elastic, neither knotted together, tender, nor fluctuating. There was no redness of the skin. A few small glands could be felt on the other side of the neck, but none abnormally enlarged in the axillæ or in the groins. There was no leucocytosis, and the spleen was not enlarged.

The glands were removed from the left side of the neck on October 7, 1892. The patient was discharged well October 15. Fowler's solution in one minim doses was ordered three times a day.

On October 2, 1893, Dr. Beach removed two small glands which had appeared in the region of the scar. The health had

been excellent. Had taken Fowler's solution for a few months after discharge from the hospital. In June, 1893, one small gland, back of the old incision, was removed. A large gland was shelled out from the left submaxillary region. The glands were dark-colored and looked malignant. He was discharged well on the 8th of June.

In October, 1896, this patient, now aged eight, re-entered the hospital. Soon after his discharge, in 1893, small lumps were noticed in the left axilla. These gradually increased in size. They never were painful. Their growth from December, 1895, to October, 1896, was rapid. The child had been under treatment by Dr. Fitz, and had taken Fowler's solution. He was generally well and active.

Physical examination showed a boy of good development and nutrition, but of pale color. A large mass was evident in the left axilla. It extended to the border of the pectoralis major. It involved the tissues of the anterior and posterior surfaces of the scapula, as well as the scapula itself. The mass was firm and elastic. Posteriorly the skin over the tumor was adherent, raised, and discolored, evidently infiltrated directly from the scapular mass. In the posterior triangle of the neck there was a movable, well-defined tumor, as large as an olive, and two as large as peas. A small, hard mass was also perceptible just below the left clavicle.

On October 5, 1896, an extensive dissection was made of the axilla and of the mass about the scapula. The incision extended from the upper portion of the axilla downward in the mid-axillary line, passing over the summit of the tumor. The growth was found to infiltrate the border of the pectoralis major and the latissimus dorsi. It was dissected away from these muscles, the incision being enlarged sufficiently by backward extension. The dissection was carried down to the axillary artery and vein, and backward to the scapula. In the front the tumor was less adherent; but behind the new growth merged imperceptibly into the skin, which was hard and, on section, porky. The induration and the infiltration involved and surrounded the axillary vessels. Further dissection was not attempted, the pulse and respiration being found too poor to warrant prolonging the operation. The posterior triangle of the neck was not touched. The wound was closed with silkworm

gut. A gauze wick was left in for drainage. The wicks were removed on the 6th. On the 8th he was out of doors; on the 9th he was in a wheeled chair. On the 18th the temperature was found to be 103° F. A fluctuating spot at the upper angle of the wound was opened, and about an ounce of pus removed. Sulpho-naphthol dressings were ordered for the whole wound, which had become septic. The temperature remained high. On the 1st of November the respiration became labored. On the 2d of November he was seen by Dr. Fitz, who found the left chest dull in the lower back, with absence of respiration. The pleural cavity was aspirated just below the angle of scapula, and fifteen ounces of a turbid fluid were removed, with great relief to respiration. The pulse was from 180 to 200. It did not seem possible for the boy to recover. The axillary wound healed slowly by granulation; the pleurisy became an empyema. This was finally opened freely. With the existence of the extensive wound infection, the induration about the scapula disappeared, and the tumor slowly subsided. At the end of six months I visited the boy at his home in Townsend, and there was no sign whatever of the mass. The scapula rested in its normal position upon the thorax, the induration of the tissues had entirely disappeared, with the discoloration and infiltration of the skin. There was not the slightest evidence of any growth about the scapula.

The microscopic report from Dr. Whitney was as follows:

"A large, lobulated mass, composed of glands and fibrous tissue, which had infiltrated the muscles. The mass was nearly the size of the two fists. Microscopic examination showed the structure to be solid masses of small round cells, separated by relatively large areas of connective tissue. In places these could be seen following the course of the blood-vessels in the perivascular lymph-spaces. Round-celled sarcoma originating in the lymph-glands."

I have been able to examine this boy several times since he left the hospital. There is no doubt whatever of the complete disappearance of the tumor of the axilla and of the scapula. At my last examination I found one or two en-

larged glands on the *right* side of the neck. The boy wrote me in August, 1898, that he was feeling very well.

On August 18, 1898, I made a very careful examination of this boy. The region formerly occupied by the axillary and scapular tumor was entirely free from even a suspicion of involvement. There was, however, an evident metastasis in the mediastinum. He died suddenly two days later.

THE ANATOMY AND SURGERY OF THE FRONTAL SINUS AND ANTERIOR ETHMOIDAL CELLS.

By HOWARD A. LOTHROP, M.D.,

OF BOSTON,

ASSISTANT IN ANATOMY, HARVARD UNIVERSITY.

(Continued from page 638.)

*Inferior Border.*—The inferior border is convex downward and forward. It arises superiorly in contact with the middle turbinate and nasal process of the superior maxilla, but for the rest of its course it is somewhat variable. As a rule, in the bony state, it follows down the posterior part of the inner surface of this nasal process, touches the lachrymal bone, and is free to the posterior extremity of the process.

Common variations are the following:

(1) Processes connecting with the lachrymal bone. (Plate 11.)

(2) Direct contact with nearly the whole of the lower part of the lachrymal line. (Plate 22.)

(3) Contact with lachrymal process of the inferior turbinate bone. (Plates 22, 24.)

(4) Union with ethmoidal process of the inferior turbinate bone,—very common. (Plates 4, 9.)

On the contrary, in the natural state, this border is never free, but unites with the lower or deepest portion of the gutter of the infundibulum, and is continued inferiorly as part of the internal antral wall. The ostium maxillare will be considered with the infundibulum.

*Superior Border.*—The superior border of the uncinate process is free both in the bony and natural state. It forms

a concavity roughly parallel with the prominence of the bulla ethmoidalis, and in the natural state the slit between these parts has received the name of hiatus semilunaris, and is the only entrance to the infundibulum from the nasal cavity. (Plates 8, 22, 24, 33, 38, 39.) The mode of connection of its upper portion with the bulla ethmoidalis is the determining factor as to the extent of the naso-frontal duct, the extent and form of the upper portion of the infundibulum, and other relations of much surgical importance. These will be considered in connection with the modes of entrance to the frontal sinus.

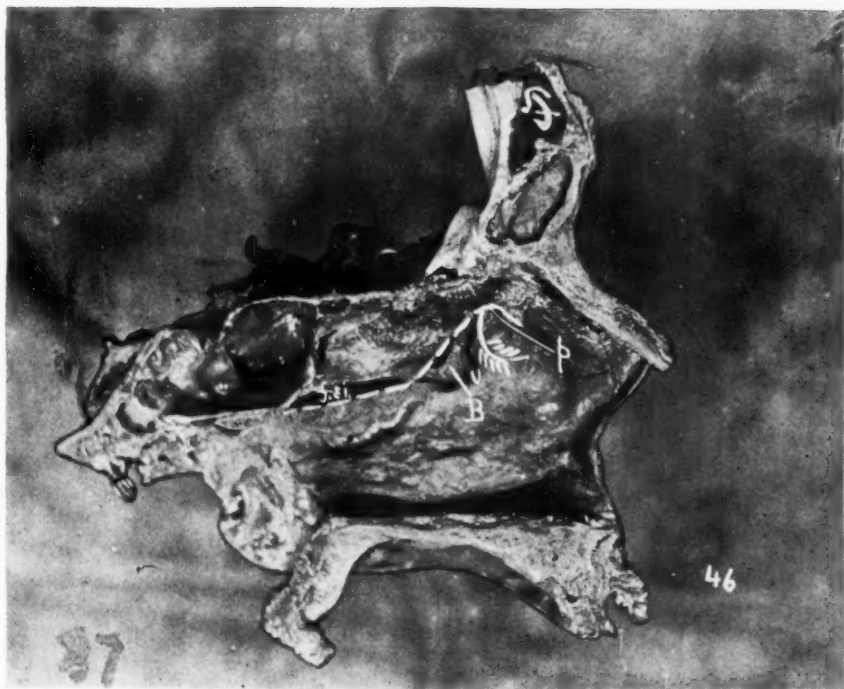
*Posterior Extremity.*—The posterior extremity of the uncinat process lies approximately in the centre of the hiatus maxillaris, in the partial closure of which it plays a small part (Plates 5, 9, 11); but occasionally it may nearly fill this bony hiatus by means of a very thin expanded lamina, one side of which is covered by antral mucous membrane, the other by nasal mucous membrane.

Two processes are very constant from this extremity, the maxillary and turbinate. (Plates 5, 9, 11, 23, 24, 26.) These processes arise more commonly from the inferior portion of the extremity, the maxillary process, as though it was the end of the processus uncinatus, bent up and carried upward and outward to the edge of the orbital surface of the superior maxilla. This process may be multiple or its completion may be wanting, but its presence is always partially indicated. If complete, it forms the posterior border of the ostium maxillare, and under these circumstances the normal entrance to the maxillary sinus is entirely surrounded by bone (Plates 23, 26), otherwise this boundary must be completed by membrane. This reflected maxillary process terminates the lower extremity of the gutter or floor of the infundibulum.

The turbinate process passes down from the lower border of the uncinat process between layers of antro-nasal mucous membrane to meet the ethmoidal process of the inferior turbinate bone. (Plates 4, 9, 24.) This process, to-



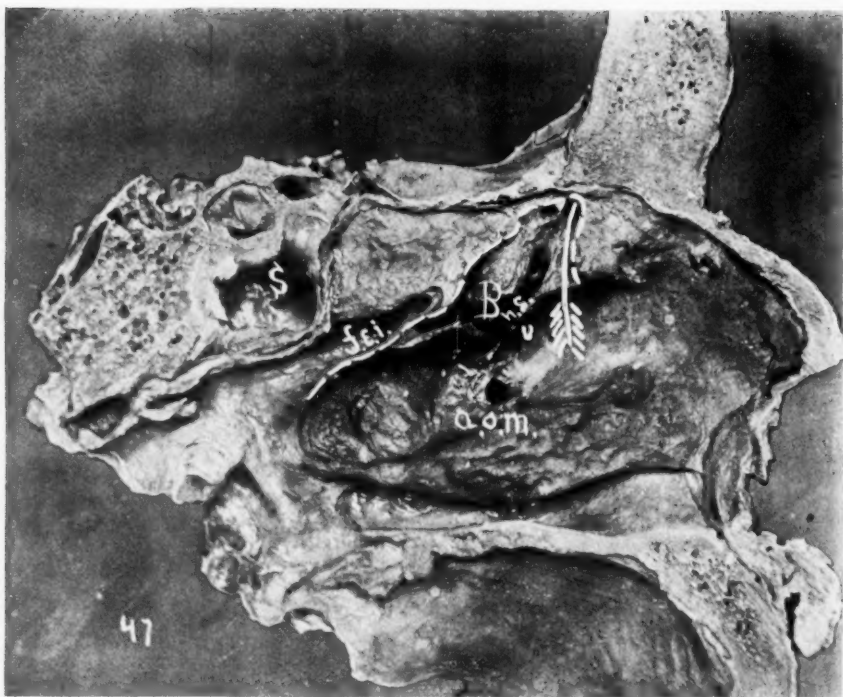
Plate 46.



LEFT NASAL FOSSA, EXTERNAL WALL, SPECIMEN REDUCED IN SIZE,  
MIDDLE TURBINATE REMOVED.

*B.* Ethmoid Bulla small, but markedly convex forward and downward so as to over-lap the Uncinate process. *U.* Uncinate process. Arrow is lost in a blind Infundibulum. *p.* Probe passing through turbinate fossa to frontal sinus. *f.e.i.* Fissura ethmoidalis inferior.

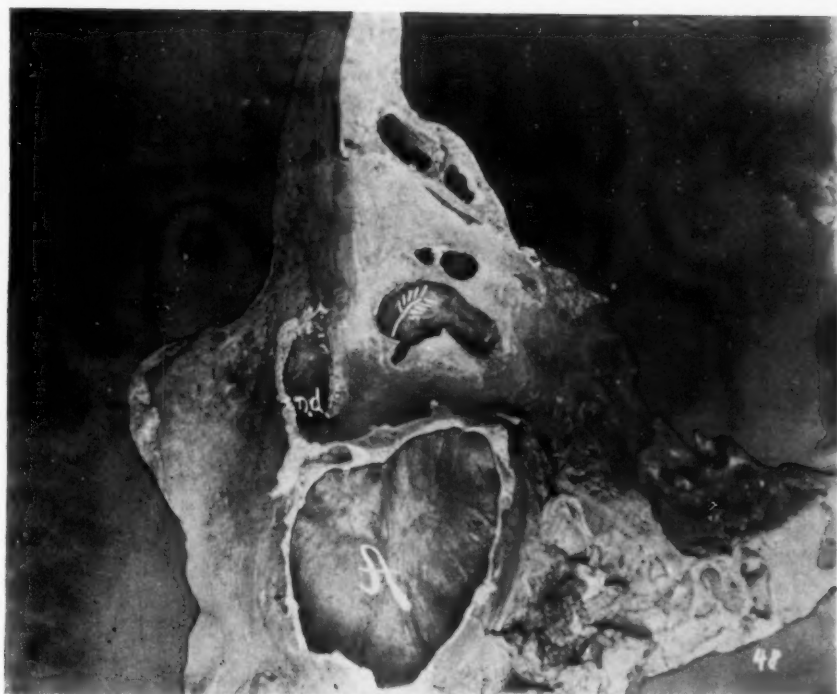
Plate 47.



LEFT NASAL FOSSA, EXTERNAL WALL, MIDDLE TURBinate REMOVED.

Arrow passes through turbinate fossa to frontal sinus. *B.* Cavity of Bulla ethmoidalis opened on section. *U.* Uncinate process. *h.s.* Broad Hiatus Semilunaris. *a.o.m.* Accessory Ostium maxillare. *f.e.i.* Fissura ethmoidalis inferior. *S.* Sphenoidal sinus.

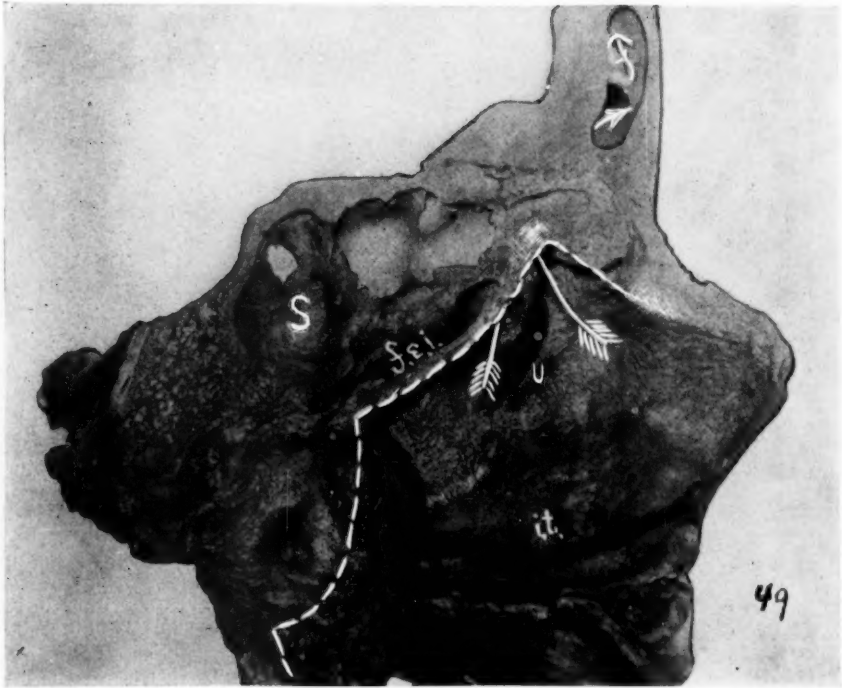
Plate 48.



INTERNAL WALL OF LEFT ORBITAL FOSSA, SHOWING EXTENSIVE DEHISCENCE  
OF OS PLANUM, WHICH COMMUNICATES WITH THE CELLS OF THE  
ETHMOID BULLA. ARROW PASSING THROUGH DEHI-  
SCENCE TO THE CELLS OF THE BULLA  
ETHMOIDALIS.

*n.d.* nasal duct. *A.* Antrum.

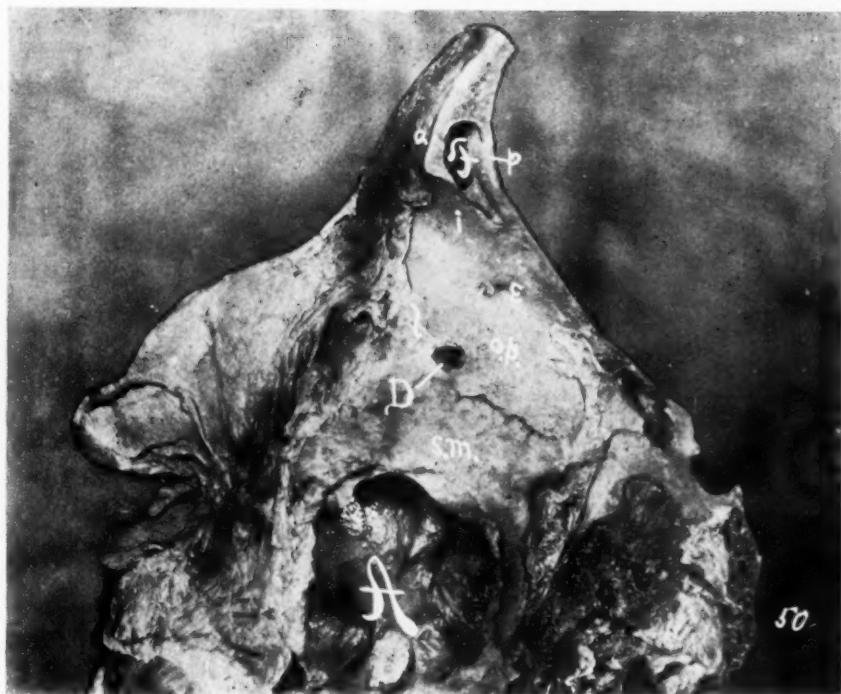
Plate 49.



NASAL ASPECT OF SAME SPECIMEN, MIDDLE TURBINATE REMOVED AND LEFT HANGING.

*B.* Bulla ethmoidalis. *U.* Processus Uncinatus. Arrow passes through the ostium of the Bulla ethmoidalis and the dehiscence of the Os Planum, into the orbital fossa. The upper arrow passes through the turbinate fossa and ostium frontale to the frontal sinus. *F.* Frontal sinus. *S.* Sphenoidal sinus. *f.e.i.* Fissura ethmoidalis inferior. *i.t.* Inferior turbinate.

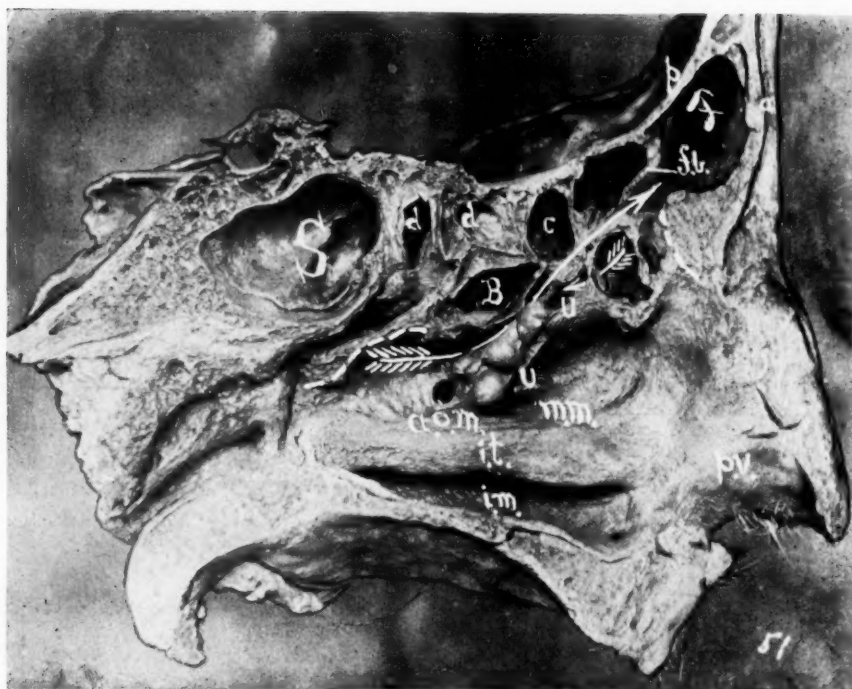
Plate 50.



INTERNAL WALL OF LEFT ORBITAL FOSSA, TO SHOW A SMALL DEHISCENCE  
BETWEEN THE LACHRYMAL BONE AND OS PLANUM.

*o.p.* Os Planum. *l.* Os lachrymale. *s.m.* Orbital surface of superior maxilla.  
*F.* Frontal sinus. *a.* Anterior wall. *p.* Posterior wall. *i.* Inferior wall. *e.* Anterior ethmoidal foramen. *D.* Dehiscence. *A.* Antrum.

Plate 51.



SAGITTAL SECTION TO LEFT OF MEDIUM LINE, EXPOSING THE FRONTAL SINUS AND ETHMOIDAL CELLS.

*F.* Frontal sinus. *a.* Anterior wall. *p.* Posterior Wall. *fb.* Frontal Bulla protruding into frontal sinus; its cell large. *U.* Uncinate process to which are attached numerous polypi so as to obstruct the Hiatus semi-lunaris. The anterior portion of the uncinate process has been partly removed so as to expose a large cell situated between this process and the lachrymal bone. Its ostium is marked by an arrow directed toward the Infundibulum. This cell is of very constant occurrence. *B.* In cell corresponding to Bulla ethmoidalis. Dotted lines indicate points of removal of middle turbinate. *S.* Sphenoidal sinus. *c.* An Anterior ethmoidal cell. *i.t.* Inferior turbinate. *p.v.* Plica vestibuli. *a.o.m.* Accessory Ostium maxillare. *d.* Posterior ethmoid cells. *i.m.* Inferior meatus. *m.m.* Middle meatus. The long arrow passes through the Hiatus Semi-lunaris into the Infundibulum, which is converted into a canal by polypi, thence through the exposed naso-frontal canal into the frontal sinus.

gether with others which may radiate from this extremity, does not concern us.

*Ethmoidal Cells.*—The ethmoidal cells are bony cavities, located, for the most part, in the lateral masses of the ethmoid bone (Plates 17, 21, 77), many of which are completed by articulation with neighboring bones, as already mentioned. These cells communicate with the nasal cavity by means of ostia which are to be found in the fissuræ ethmoidales or their homologues (hiatus semilunaris and fissure between bulla ethmoidalis and upper border of the inferior ethmoidal turbinate). (Plates 29, 30, 38, 46.)

Theoretically, it is fair to assume that there is some regularity in the arrangement of the septa which go to form these cells, but it is often very difficult to follow out this plan in practice. Zuckerkandl has suggested the following arrangement of bony septa, which is very satisfactory at least for descriptive purposes. The labyrinth is bounded laterally and above by bony walls, which have been described in sufficient detail. Now, running across between these lateral boundaries are septa obliquely placed, corresponding to the lines of origin of the various ethmoidal turbinate bodies,—viz., in the line of the fissuræ ethmoidales. Most of these laminæ join the os planum, the others the lamina cribrosa. These planes are intersected by septa placed vertically in a lateral direction, which divide the mass into cells of somewhat equal proportion. Such an ideal arrangement, of course, naturally never exists. Certain cells are uniform and larger than others. Certain cells exist in some cases, are absent in others, and the shape of corresponding cells is never the same. This irregularity is to be explained by the crowding of the septa in one direction or the other, the addition of new septa and the loss of others.

The embryology of the ethmoid bone would suggest that the cells first appear and grow by the development of pockets or diverticula from the cartilaginous nasal wall during the early years of infancy.

The ethmoidal cells of the adult are divided into two groups, anterior and posterior. The former include all cells opening under the inferior ethmoidal turbinate bone ("middle turbinate") into the hiatus semilunaris or the fissure above the bulla ethmoidalis. The latter group includes all cells having their ostia in the one to three fissuræ ethmoidales. Hence these cells open above the middle turbinate.

As a rule, the posterior cells are fewer yet larger than the anterior, and their ostia are much larger.

Although the posterior cells may be involved in acute processes as often as the anterior, spontaneous resolution is more apt to follow, according as the general nasal mucous membrane becomes normal, on account of the large size of the ostia. The smaller ostia of the anterior cells are more easily obstructed by polypi and hypertrophies, hence are more frequently the site of chronic suppurative processes. We will dismiss the posterior cells without further consideration.

We have now to study the anterior ethmoidal cells and their relations.

*Bulla Ethmoidalis.*—The bulla ethmoidalis (Zuckerkancl) or promontorium (Zoja) is a very constant eminence, of considerable importance as a landmark, made by the prominence of the walls of one or, less frequently, several ethmoidal cells. (Plates of most sagittal and many coronal sections.) It is situated on the lower inner aspect of the lateral mass, under cover of, and partially concealed by, the middle turbinate bone, and is immediately above the posterior half of the processus unciformis, with which it helps form the hiatus semilunaris.

The bulla presents itself as a more or less prominent, smooth, and rounded eminence, which is open to considerable variation both as regards size and shape. It is best observed on removal of the middle turbinate bone. The prominent convex surface of the bulla looks inward, forward, and downward. (Plates 22, 34.) If this surface is followed backward,



it is seen to be continuous with the horizontal portion of the posterior part of the middle turbinate, directly under the fissura ethmoidalis inferior. Following the surface downward and outward, we come to the under surface of the orbital wall of the superior maxilla, and pass to the maxillary sinus (Plate 21), but in the natural state our progress would be arrested by the membranous inner wall of this sinus, unless, perchance, we should be in the location of the ostium maxillare, when our progress into the sinus would not be interrupted. (Plates 61, 62, 69, 70.)

Passing forward and outward over the bulla, its convex anterior surface is limited by, and corresponds very accurately to, the anterior border of the lamina papyracea. (Plate 21.) If we follow the eminence of the bulla backward and a little upward, we are arrested by a fissure formed by the junction of this surface with the insertion of the middle turbinate. (Plates 4, 10, 38, 40, 41.) Near the lower part of this fissure is an ostium leading to the sinus of the bulla. This ostium is elliptical, and rarely located low enough to drain the bulla without residuum. There are usually one or more additional ostia in this fissure, situated above the one to the bulla which lead to cells located nearer the floor of the frontal sinus. Instead of several ostia in this fissure, we may have one long elliptical ostium, extending quite to the lamina cribrosa, so as to measure ten millimetres to fifteen millimetres. (Plate 42.) At the bottom of this long opening can be seen septa giving rise to cells.

In most instances the prominence of the bulla is due to a single, rather large cell, which extends outward until arrested by the lamina papyracea. (Plates 62, 67.) It is not unusual to have two cells form the bulla, only one of which reaches to the orbital wall. (Plate 70.) These upper cells extend between the laminæ of the horizontal plate of the frontal bone, and may push forward into the posterior border and posterior angle of the frontal sinus. The frontal bulla (Plate 53), to be considered presently, may be formed thus.

As a rule, the antero-inferior convexity of the bulla ethmoidalis corresponds to the upper concavity of the uncinate process, and forms the superior boundary of the hiatus semilunaris and a considerable extent of that of the infundibulum.

To summarize the relation of the ethmoid bulla, together with the cell of which it is a part, we have,—

Anteriorly and inferiorly, the infundibulum and hiatus semilunaris, with the processus uncinatus.

Internally, inferior ethmoidal turbinate bone.

Superiorly, a group of anterior ethmoidal cells, extending forward and sometimes backward, otherwise posterior cells reach over the bulla.

Posteriorly, the horizontal portion of the middle turbinate shutting off the fissura ethmoidalis inferior, and posterior ethmoidal cells. (Plate 75.)

Externally, the lamina papyracea.

*Variations in the Bulla Ethmoidalis.*—The average bulla is about ten millimetres long, and extends over the superior border of the processus uncinatus towards the median line about two to five millimetres. (Plate 67.) Its whole convexity is rather uniformly prominent. As extremes, the longest bulla observed measured twenty-six millimetres, and the widest, thirteen millimetres. The smallest bulla consisted of a nearly flat lamina of bone, the free edge of which served to separate the hiatus semilunaris from the ostium of the bulla. (Plates 4, 33.)

Occasionally the convexity is drawn out like a nipple, directed downward so as to project below and internal to the uncinate process. (Plates 42, 44, 46.) In a few cases the bulla may be in contact, particularly in the recent state, with the superior border of the uncinate process, and be a serious hinderance to instrumentation. (Plates 25, 31, 37, 41.) A wide bulla may crowd the turbinate against the septum nasi. (Plate 67.)

*Orbital Dehiscences.*—Defects in the orbital wall of the labyrinth, known as dehiscences, are very unusual, except in connection with the lachrymal bone. These need no men-

tion. Two cases have been observed where the os planum was partly defective and the bony lamina replaced by membrane. In both instances, the sinus of the bulla communicated with the orbital fossa.

These cases are pictured in Plates 48, 49, 50, but their great rarity divests them of much practical importance, otherwise they would offer little resistance to the passage of pus, either from the orbital fossa to the nasal fossa or *vice versa*, or give rise to emphysema within the orbit.

*Hiatus Semilunaris* (Plates 4, 8, 10, 11, 12, also 30 to 47 inclusive).—The hiatus semilunaris is a half-moon-shaped opening, as its name suggests, which leads from the nasal cavity (middle meatus) into the infundibulum. (Plates 65, 67, 75.) The parts which bound this opening have been more or less fully considered.

In the bony state, as well as the recent, the superior border is formed by the convex surface of the bulla ethmoidalis, the inferior border by the superior free margin of the processus uncinatus. (Plates 22, 38, 39.) Posteriorly there is no bony limit, so that this portion of the lumen is completed by mucous membrane passing between these two bony landmarks. (Plates 11, 12.)

The anterior limit of the hiatus semilunaris is variable. It is made by the presence of a bony lamina passing from the anterior portion of the superior border of the processus uncinatus to the bulla ethmoidalis, or its continuation upward. (Plates 4, 8, 31, 34, 41, 45, 49.) Very occasionally this septum is membranous. Another not unusual mode of closure of the anterior end of the hiatus is observed where the insertion of the superior border of the middle turbinate passes directly across from the upper end of the bulla ethmoidalis to the processus uncinatus, without the usual formation of a pocket or sinus under the anterior upper extremity of this turbinate. In other words, what we are to designate as turbinate fossa later is not always separated from the upper extremity of the infundibulum by a septum, but these two cavities become one. (Plates 30, 40.)

A third variety, somewhat less common than the first, is where no such lamina is present until the hiatus has extended nearly or quite to the roof of the nasal fossa, under cover of the middle turbinate bone, close to the ostium frontale. (Plates 11, 12, 33.)

Thus we have three types of closure of the anterior end of this hiatus, which are of great importance in determining the route to the frontal sinus.

(1) By means of a septum between uncinatè process and ethmoid bulla.

(2) Septum absent, hiatus reaches practically to orbital roof.

(3) No septum, as in Plate 4, but the middle turbinate takes its place. Really no fossa turbinalis present.

Ordinarily, the long boundaries of the hiatus are nearly parallel, and from two to five millimetres apart; the length of the hiatus will average about fifteen millimetres, with extremes at ten millimetres and thirty millimetres.

The hiatus semilunaris may be narrowed:

(1) By over prominence of the bulla ethmoidalis antero-inferiorly. (Plates 31, 42, 46.)

(2) By tilting the processus uncinatus in one of two directions,—viz., pushing the process as a whole, or either extremity, backward, or by rotating the upper border outward towards the bulla. (Plates 25, 67.)

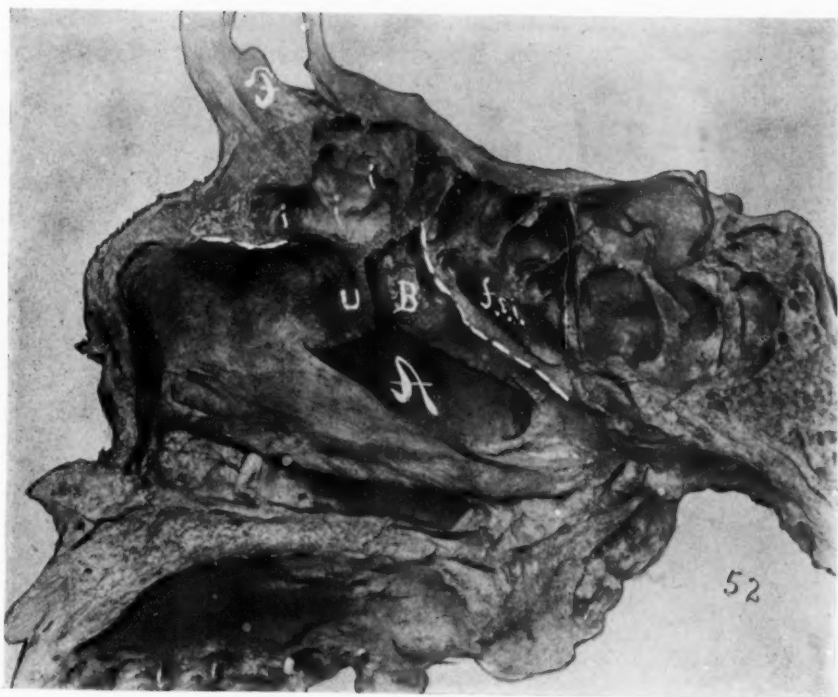
(3) By the addition of the soft parts. (Plate 32.)

(4) By pathological processes,—hypertrophies and polypi. (Plates 37–51.)

(5) Its lumen may be obstructed by abnormal proximity of the inferior ethmoidal turbinate bone. (Plate 61.)

*Infundibulum* (all plates showing hiatus semilunaris, ethmoid bulla, and processus uncinatus).—The hiatus semilunaris is the ostium of the infundibulum, so that the latter is always as long, and in almost every instance is somewhat longer. The infundibulum is a sort of foyer between the nasal cavity, on the one hand, and certain ethmoidal cells, the maxillary sinus and the frontal sinus in half of the cases,

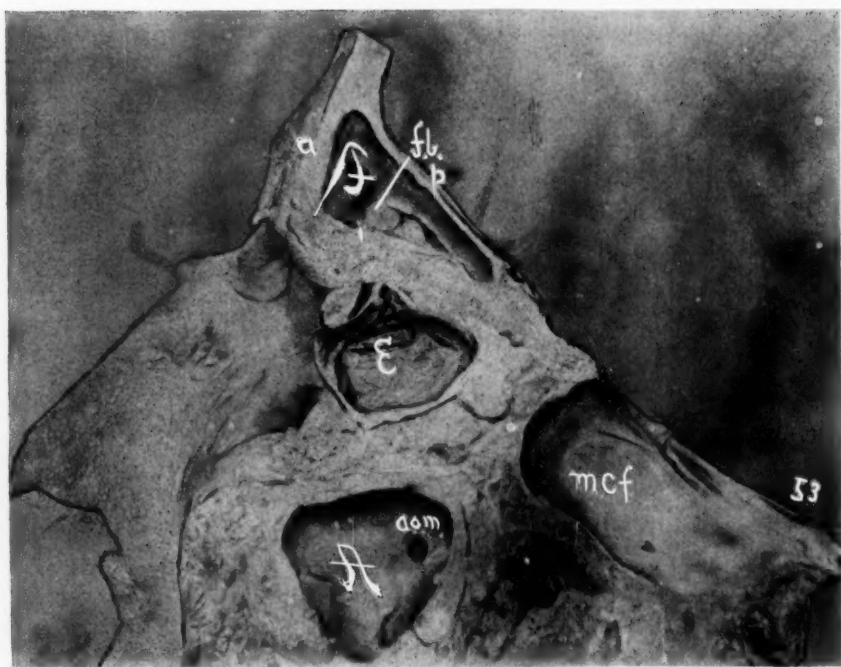
Plate 52.



SAGITTAL SECTION TO RIGHT OF MEDIAN LINE, LOWER PORTION OF UNCINATE PROCESS REMOVED, AND LARGE OPENING MADE INTO ANTRUM, MIDDLE TURBINATE REMOVED.

*F.* Frontal sinus. *A.* Antrum. *B.* Bulla ethmoidalis. *i.* Large cell just external to upper end of Infundibulum which has been removed. *f.e.i.* Fissura ethmoidalis inferior. *U.* Uncinate process.

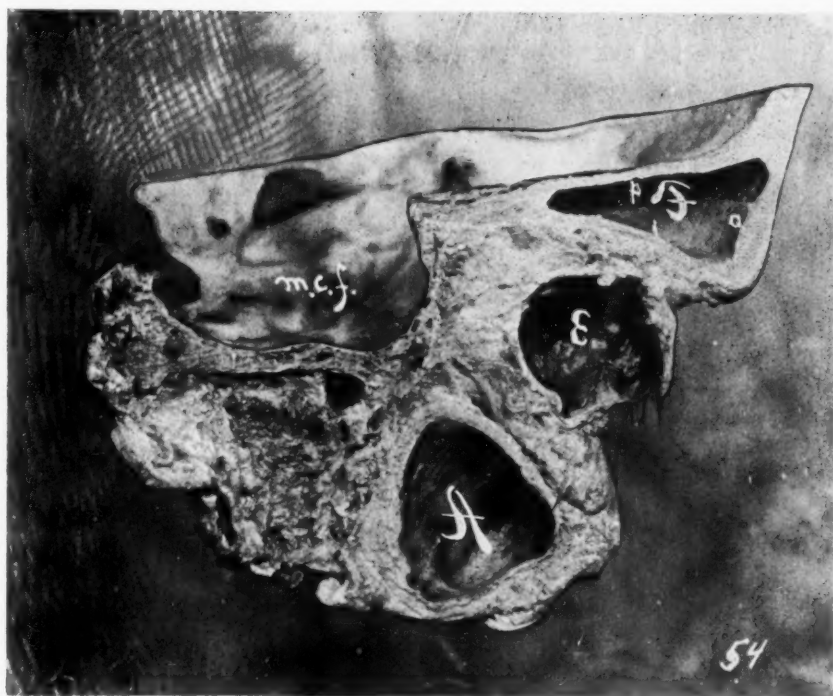
Plate 53.



SAGITTAL SECTION THROUGH EYE-BALL, INTERNAL HALF, SHOWING THE TRI-  
ANGULAR SHAPE OF THE FRONTAL SINUS.

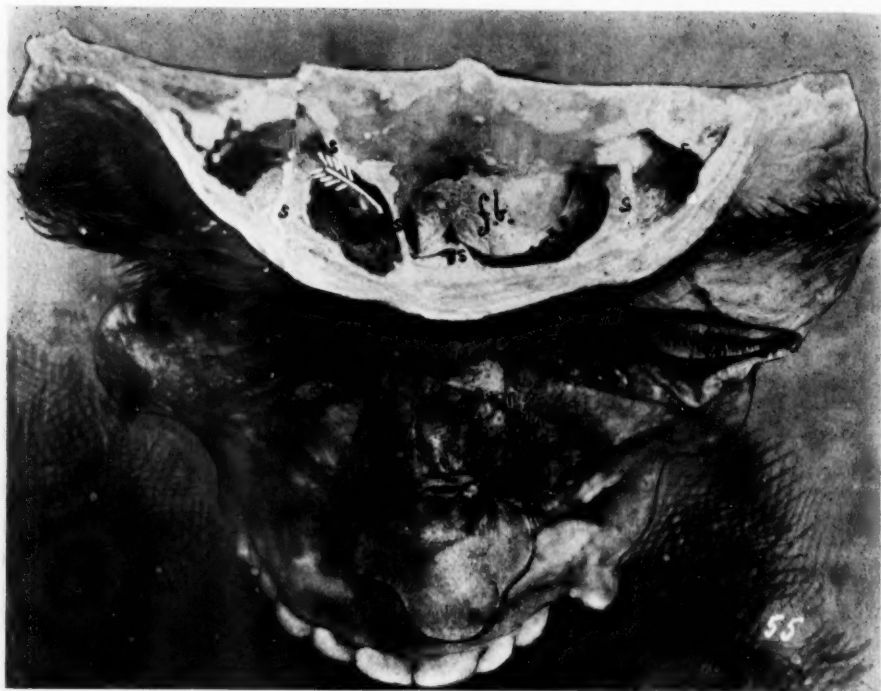
*F.* Frontal sinus. *a.* Anterior wall. *i.* Inferior wall. *p.* Posterior wall.  
*fb.* Large frontal bulla. *A.* Antrum. *a.o.m.* Accessory Ostium maxillare. *E.*  
Eyeball. *m.c.f.* Middle cranial fossa. See Plate 54.

Plate 54.



SAME SPECIMEN, EXTERNAL HALF, LETTERS CORRESPOND. (SEE PLATE 53.)

Plate 55.

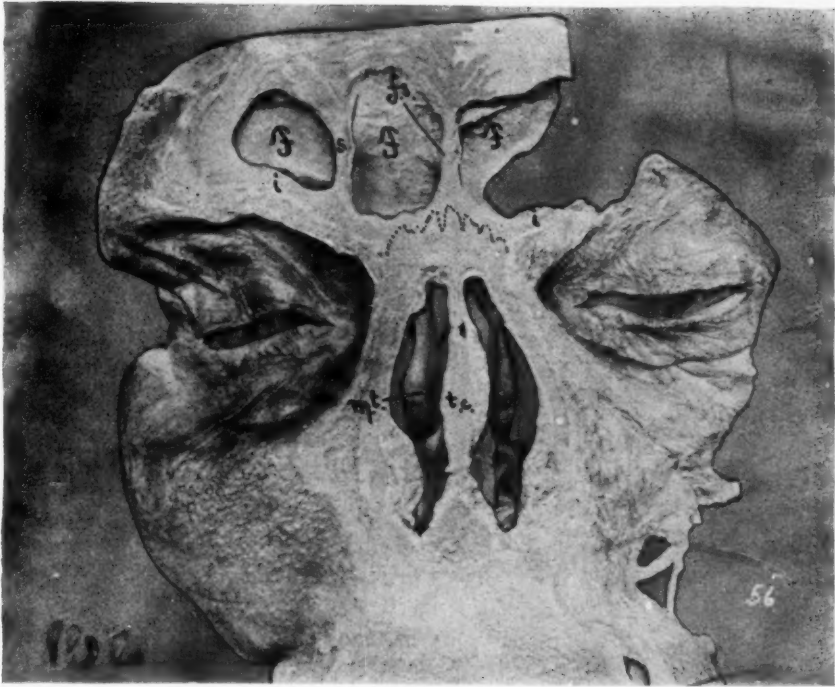


CORONAL SECTION LOOKING INTO A LARGE FRONTAL SINUS, CONTAINING NUMEROUS SEPTA BUT NO INTER-FRONTAL SEPTUM. BOTH SINUSES FORM ONE CAVITY. ARROW MARKS THE PRESENCE OF A SINGLE OSTIUM FRONTALE WHICH OPENS INTO THE RIGHT TURBinate FOSSA. NO OSTIUM FRONTALE ON THE LEFT OF THE MEDIAN LINE.

*s.s.s.* Various incomplete septa of the common frontal sinus. *f.b.* Frontal bulla on left side which opens into the left turbinate fossa.



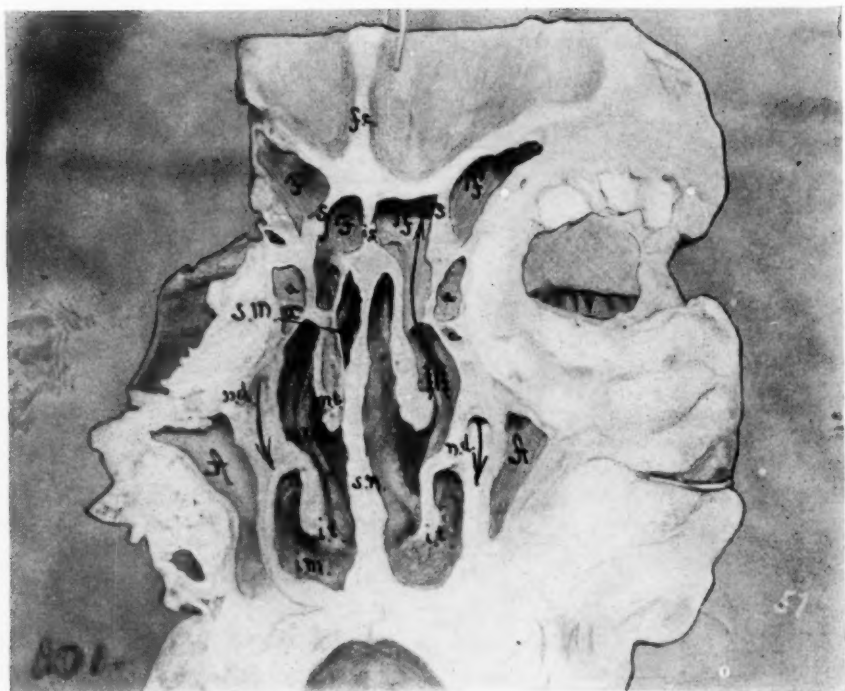
Plate 56.



CORONAL SECTION THROUGH FRONTAL SINUS.

*f.* Frontal sinus, posterior wall. *f.s.* Septum between frontal sinuses. *s.* Thick Septum in the right frontal sinus, dotted line marks the suture between the frontal bone on the one hand, and the nasal and superior maxillary bones on the other hand. *m.t.* Middle turbinate. *i.* Inferior surface of frontal sinus (orbital portion). *t.c.* Triangular cartilage of nasal septum.

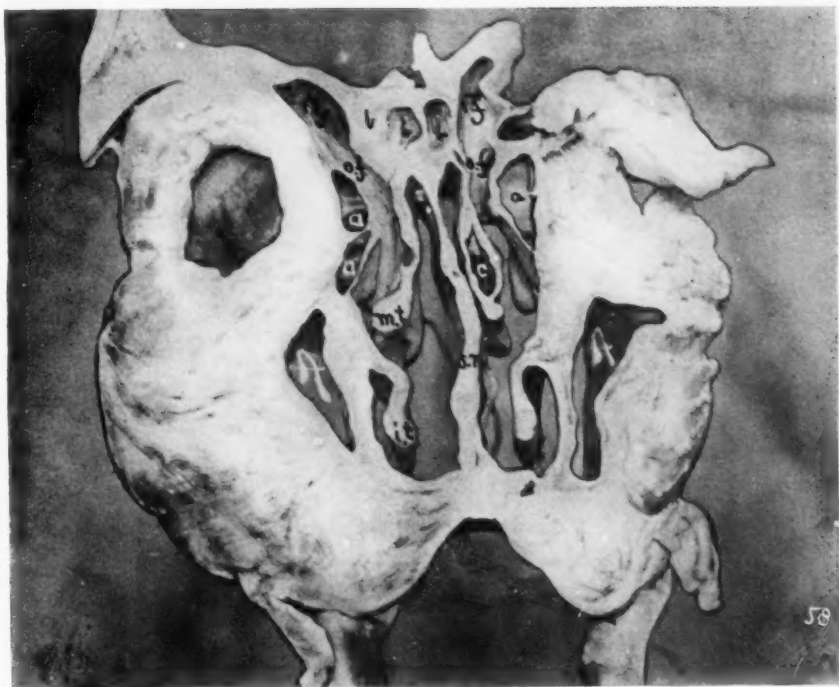
Plate 57.



CORONAL SECTION THROUGH POSTERIOR PORTION OF FRONTAL SINUS PASSING THROUGH NASAL CANAL.

*F.F.* Frontal sinuses each divided by a septum (*s*). *i.s.* Inter-frontal septum. *f.c.* Frontal crest. *m.t.* Left middle turbinate containing a cell. Arrow passing through turbinate fossa to frontal sinus. *n.d.* Nasal ducts with probes. *A.* Antrum. *i.t.* Inferior turbinate. *i.m.* Inferior meatus. *m.m.* middle meatus. *s.m.* Superior meatus. *a.a.a.* Anterior Ethmoid cells opposite lachrymal bone. *s.n.* Septum nasi.

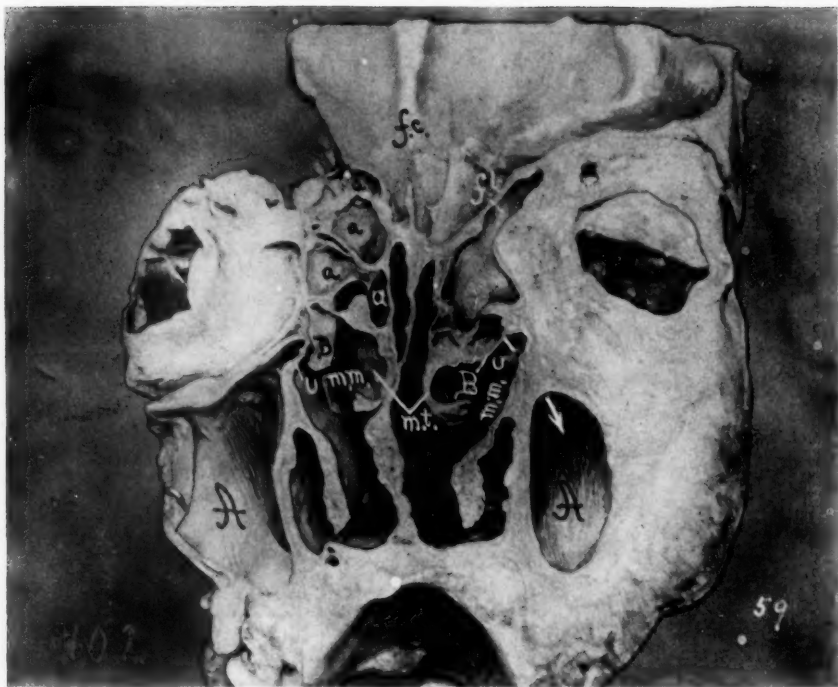
Plate 58.



CORONAL SECTION THROUGH OSTIUM FRONTALE OF BOTH SINUSES,  
POSTERIOR HALF.

*F.* Frontal sinus. *o.f.* Ostium Frontale (posterior half) at apex of turbinate fossa. *c.* Cells in left middle turbinate. *a.a.a.* Anterior ethmoid cells, opposite lachrymal bone. *b.b.* Anterior ethmoid cells internal to Ostium frontale. *A.* Antrum. *i.t.* Inferior turbinate. *m.t.* Middle turbinate. *s.n.* Septum nasi.

Plate 59.



CORONAL SECTION THROUGH THE LEFT OSTIUM MAXILLARE AND BEHIND THE  
RIGHT OSTIUM MAXILLARE, AS SHOWN BY ARROW PASSING  
FROM INFUNDIBULUM TO ANTRUM.

*A.* Antrum. *U.* Uncinate process. *f.c.* Frontal crest. *f.b.* Frontal Bulla.  
*m.t.* Middle turbinate. *a.a.a.* Anterior ethmoid cells. *B.* Bulla ethmoidalis on  
section. *m.m.* Middle meatus.

on the other hand. Like the hiatus semilunaris, the infundibulum is always present.

A considerable extent of the infundibulum is limited by mucous membrane only, so that a study of the skeleton alone is insufficient to determine its limits and shape. In general, the infundibulum is like a long, curved canal, convex antero-inferiorly, shallow at its posterior extremity, deep and generally lost to view at its anterior termination. It is bounded above by the inferior surface of the bulla ethmoidalis throughout the greater part of its extent, except anteriorly, where the bulla is replaced by certain anterior ethmoidal cells, already described. (Plates 22, 41.)

*External Surface of the Infundibulum.*—Following this on the skeleton, we generally have, below, the maxillary process of the processus uncinatus, then a fontanelle looking into the antrum of Highmore, and as we ascend we cross the free edge of the orbital plate of the superior maxilla (often separated into two laminæ for the formation of the maxillary cells), and then pass on to the inner surface of the lachrymal bone. (Plates 5, 8, 9, 23.) The under surface of the bulla and cells above it is usually extended forward to bound a part of the external surface of the infundibulum. In the recent state this surface is intact, except for the constant location of the ostium maxillare, just under the orbital roof of the antrum, and an occasional ostium from a cell in the lachrymal region. (Plates 33, 39, 40, 41.)

The *internal surface* of the infundibulum throughout its whole length is bounded by the external surface of the processus uncinatus, but its breadth is completed in part by the hiatus semilunaris, and frequently a fold of mucous membrane, which continues the concavity of the superior border of the uncinate process. (Plates 39, 40, 41, 65, 67, 70.)

When the soft parts are undisturbed, the internal and external surfaces meet below at an angle so as to form a sort of gutter, which follows the general contour of the infundibulum. The infundibulum, therefore, is comparable to a gutter, the depth of which will depend upon the width of the

processus uncinatus, together with its increase by mucous membrane, and also upon the lateral tilting of this process. (Plates 59, 65, 70.)

At the lowest portion of this concave gutter, extending somewhat on its outer side, is the ostium maxillare, well guarded and hidden from view internally by the processus uncinatus. (Plates 23, 38, 39, 40, 41, 61, 67, 69, 70, 73, 75.) The importance of this topography, as regards the drainage of pus and the association of accessory sinus diseases, will be considered in Part II, hence the importance of this detail. The posterior extremity of the gutter ascends more or less after passing the ostium maxillare, and may disappear smoothly on to the lateral wall of the nasal fossa, or be interrupted by the fold of mucous membrane to which reference has been made.

The ostium maxillare, therefore, is situated in a depression at the lowest portion of the infundibulum. Its size and shape vary within narrow limits. It is usually oval, three millimetres to five millimetres long, and about half as wide, and is placed transversely at the highest part of the antrum, close to the orbital wall. If the maxillary process of the uncinatus is complete, its contour is bony (Plate 23), otherwise mucous membrane fills in the deficiency. In 250 cases the ostium maxillare was never found wanting.

Accessory ostia for the maxillary sinus (Plates 32, 34, 35, 36, 38, 40, 41), present in about 10 per cent. of cases, do not enter into the present anatomical consideration.

Allowing a slight digression from strict anatomical description, let it be mentioned here, for the sake of emphasis, that pus, travelling from the antrum, must first pass the ostium maxillare, where it reaches the lower portion of the infundibulum, thence, in order to reach the middle meatus, it must ascend over the free edge of the uncinatus process. (Plates 65, 69, 71.) Furthermore, *that pus having once reached the infundibulum from other sources, such as the frontal sinus and certain of the anterior ethmoidal cells, must of necessity gravitate towards the ostium maxillare, and enter the antrum,*

*provided this ostium is patent.* So much with the head in the erect position, but, in that the head is constantly changing its position, this antral drainage will be favored or hindered accordingly. Elsewhere the clinical evidence on this subject will be considered.

We have now to consider the upper end of the infundibulum, the cells related thereto, the mode of entrance to the frontal sinus, and the rôle played by these structures in the formation of the nasal portion of the floor of the sinus.

The upper extremity of the infundibulum becomes enlarged, and its contour will depend on the distribution of processes sent off from the upper broad extremity of the processus uncinatus. (Plates 5, 7, 9.) On three walls, subject to constant variation, are to be observed ostia of anterior ethmoidal cells. Posteriorly are the openings (one to three) leading to cells anterior to the group situated above the ethmoid bulla, which may extend to the posterior angle of the frontal sinus. On the outer wall are the ostia, connected with the cellular spaces, completed when the lachrymal bone is *in situ*. There may be only one such ostium or as many as six in a vertical row, according to the number of cellular spaces.

Anteriorly there is a very constant ostium, which leads to a cell often of considerable size. It is the uppermost cell external to the uncinate process, which it follows anteriorly to the posterior border of the nasal process of the superior maxilla, and is completed externally by the lachrymal bone. This cell makes the prominence known as the agger nasi. Its roof is completed by the termination of the processus uncinatus, which arches over it from within outward. (Plates 5, 20, 24, 33, 35, 39, 51.)

The infundibulum may terminate above as follows:

(1) In 47 per cent. of the cases there is an ostium opening into a canal which leads to the frontal sinus. This canal is known as the naso-frontal duct.

(2) In 53 per cent. of the cases the infundibulum has no connection with the frontal sinus. In these cases the termination presents the following varieties:

(a) May end in a cell of considerable size, just internal to the upper portion of the lachrymal bone, and even as high as the internal angular process of the frontal bone. This cell often corresponds to the prominence of the agger nasi. Common. (Plates 5, 31, 52.)

(b) May end in a dilatation forming a cell in the posterior angle of the frontal sinus. Common. May terminate in the same way, except in a much more prominent cell, which has forced its way into this angle and posterior border of the sinus, forming a prominence known as the frontal bulla. A cell of sufficient prominence to be called a frontal bulla (Plates 37, 51, 55, 70, 76) is of fairly common occurrence. Of these frontal bullæ, one-third open into the infundibulum, the rest into the turbinate fossa, except an occasional one opening into the fissure between the ethmoid bulla and turbinate.

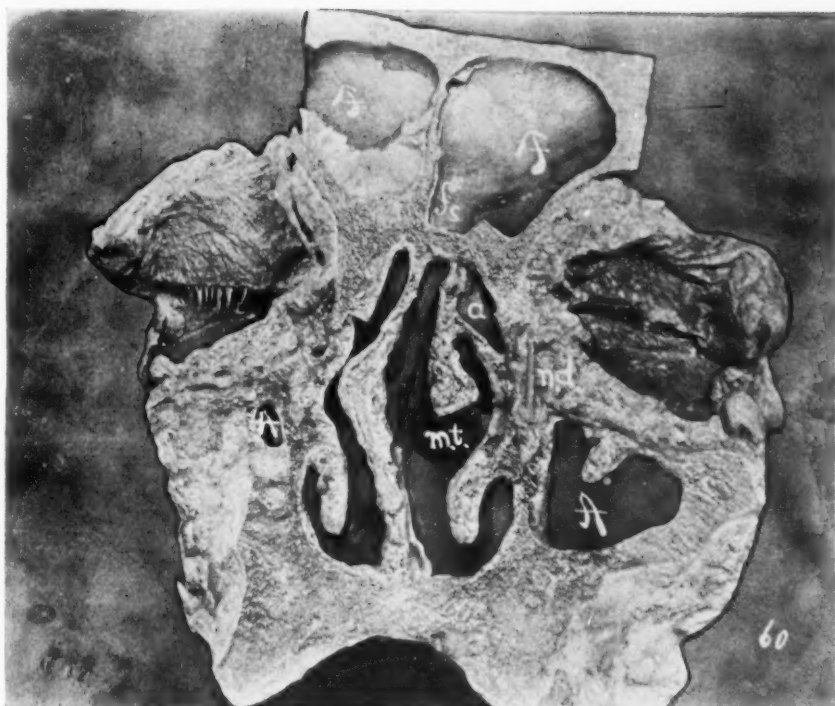
(c) Very rarely the infundibulum ends blindly without dilatation or ostia.

In 10 per cent. of all cases there is no septum between the uncinate process and ethmoid bulla (Plate 11) shutting off the infundibulum from the usual dilatation or fossa under the extreme upper and anterior portion of the middle turbinate bone. (Plates 31, 34, 38.) In these cases (Plates 11, 30, 35, 40) the contiguous surfaces of the uncinate process and turbinate are adherent throughout over the prominence known as the agger nasi. In these cases there is no diverticulum, directly under the turbinate, for the probe to enter, but it passes at once through the hiatus semilunaris into a dilatation, representing both the usual turbinate diverticulum or fossa, and the upper extremity of the infundibulum, as a single cavity. From this cavity are ostia leading in different directions, as already indicated.

*Turbinate Fossa.*—In the great majority of cases it is possible to follow up on the external surface of the inferior ethmoidal turbinate nearly to the lamina cribrosa, and yet not enter the infundibulum, which is separated by a lamina of thin bone, which passes back from the processus uncinatus



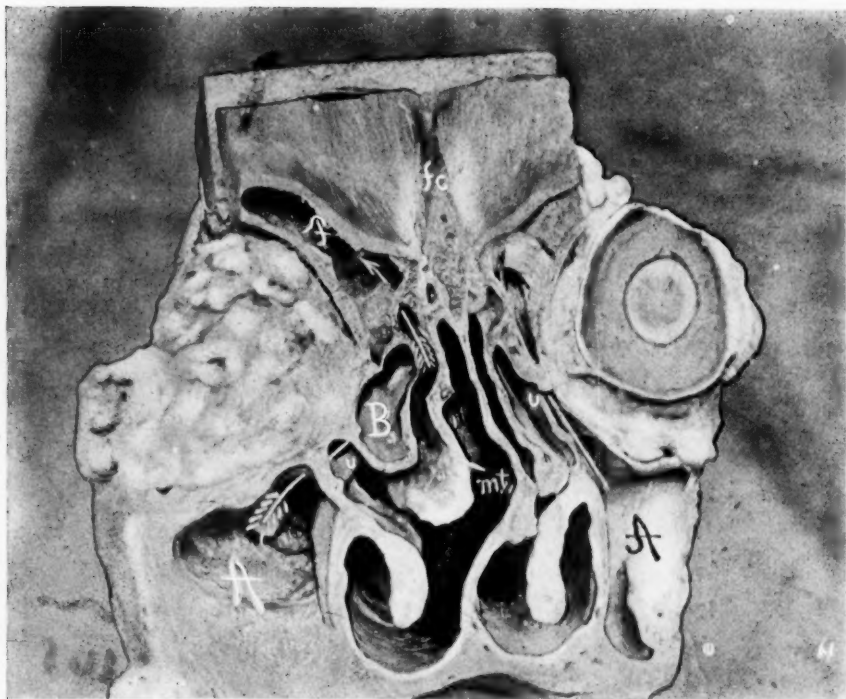
Plate 60.



CORONAL SECTION THROUGH FRONTAL SINUS PASSING THROUGH NASAL DUCTS,  
AS SHOWN BY PROBE IN LEFT DUCT. (*n.d.*)

*F.* Frontal sinus, posterior wall. *f.s.* Frontal septum, becoming thicker toward the floor of the right sinus. *m.t.* Middle turbinate with very broad lower border, in consequence of a deep turbinate sinus. *A.* Antrum. *a.* Anterior ethmoid cell.

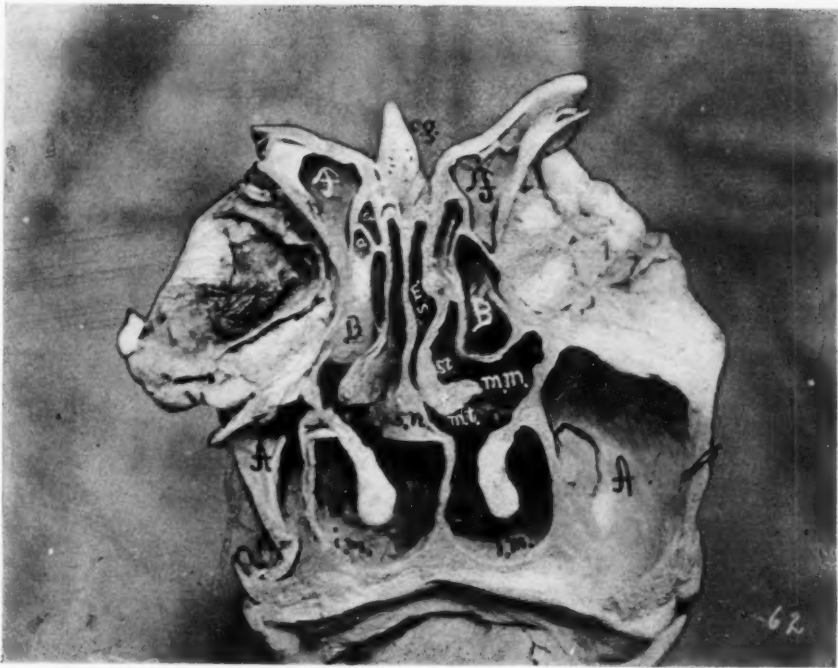
Plate 61.



CORONAL SECTION, ANTERIOR PORTION, PASSING THROUGH RIGHT OSTIUM MAXILLARE, BUT POSTERIOR TO THAT ON THE LEFT SIDE, AS SHOWN BY ARROW PASSING INTO INFUNDIBULUM. PROBE ON RIGHT SIDE, IN INFUNDIBULUM. AN ARROW PASSES FROM LEFT TURBinate FOSSA TO FRONTAL SINUS.

*F.* Frontal Sinus, showing superior and inferior walls. *B.* Bulla ethmoidalis (left) on section. *m.t.* Middle turbinate. *U.* Processus Uncinatus. *A.* Antrum. *f.c.* Frontal crest.

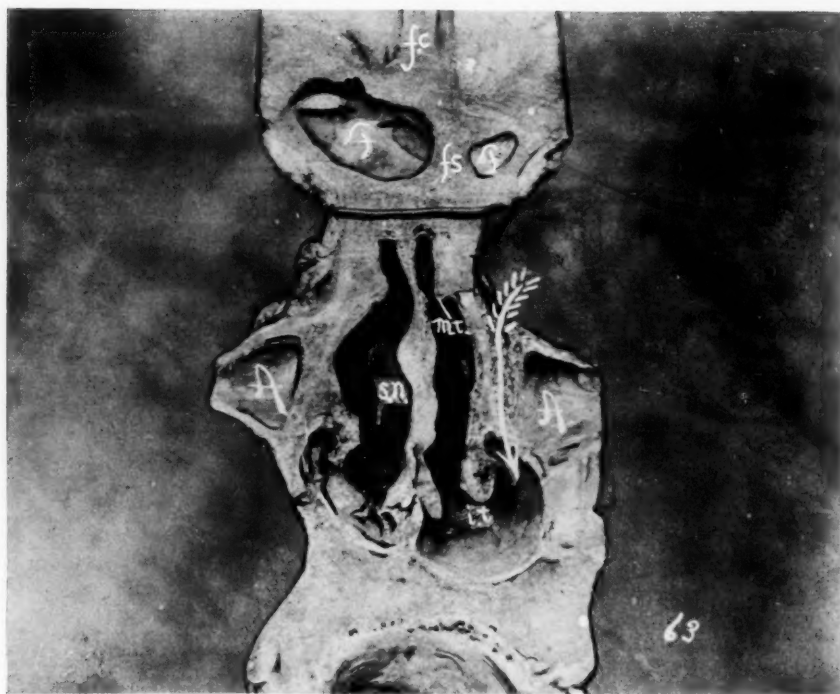
Plate 62.



CORONAL SECTION, POSTERIOR PORTION, JUST ANTERIOR TO BULLA ETHMOIDALIS ON RIGHT SIDE, BUT ON LEFT SIDE BULLA IS SEEN ON SECTION.

*F.* Frontal sinus, showing posterior and inferior walls. *B.* Bulla ethmoidalis. *a.a.* Anterior ethmoid cells just above Bulla. *m.t.* Middle turbinate much curled, forming a deep sinus turbinalis (*s.t.*) *i.m.* Inferior meatus. *m.m.* Middle meatus. *s.m.* Superior meatus. *s.n.* Septum nasi with prominent spur. *A.* Antrum. *c.g.* Crista Galli.

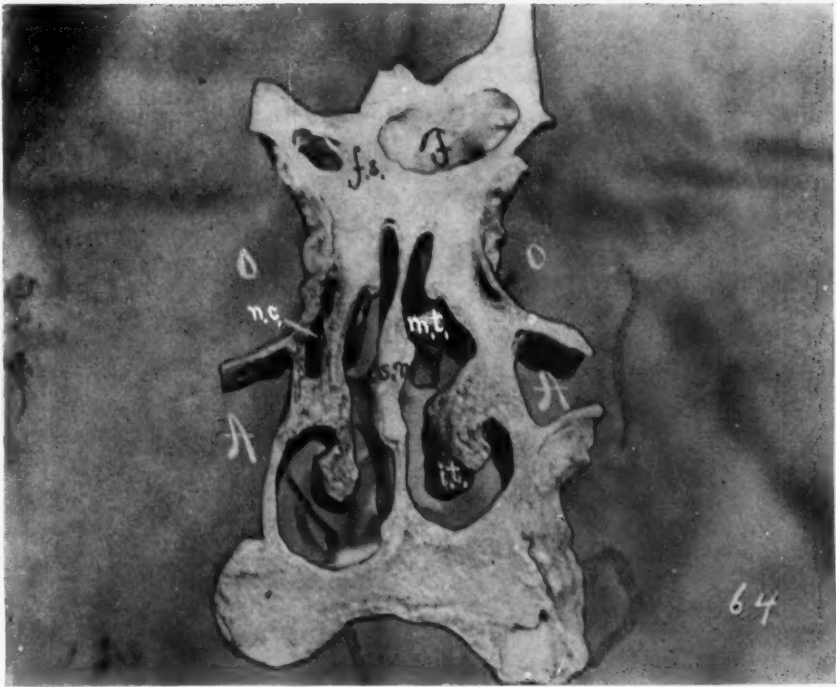
Plate 63.



CORONAL SECTION PASSING THROUGH FRONTAL SINUSES, RIGHT NASAL DUCT (ARROW) AND BOTH ANTRA. ANTERIOR PORTION.

*A.* Antrum. *F.* Frontal sinus. *i.t.* Anterior extremity of inferior turbinate. *m.t.* Anterior extremity of middle turbinate. *s.n.* Septum nasi. *f.s.* Thick septum between frontal sinuses. *f.c.* Frontal crest. A wire is seen passing across a thick portion of bone just anterior to the Hiatus frontalis, at the articulation of the frontal bone with the nasal bone and the nasal process of the superior maxilla.

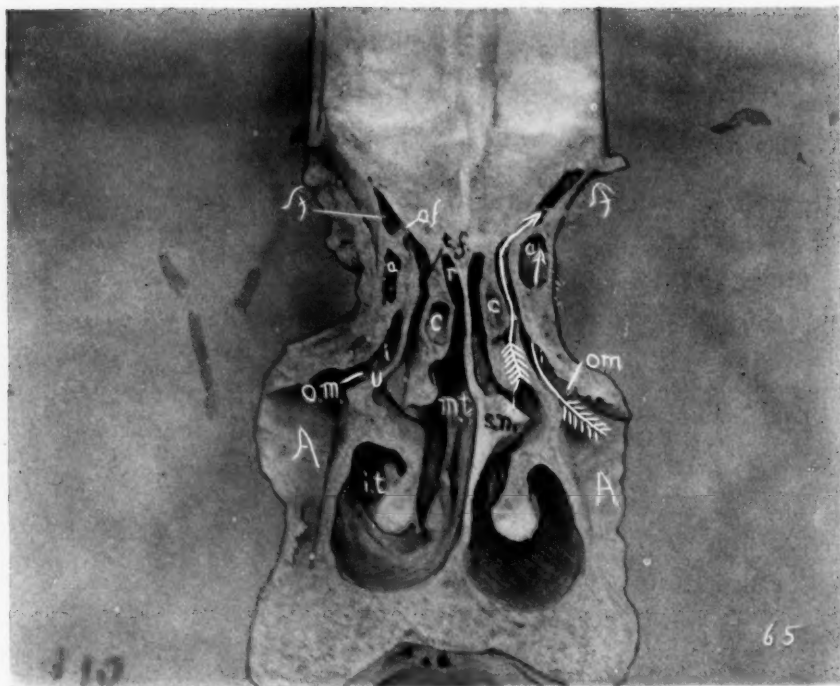
Plate 64.



CORONAL SECTION THROUGH THE FRONTAL SINUS AND NASAL DUCTS.

*F.* Frontal sinus. *f.s.* Frontal septum. *n.c.* Nasal canal. *A.* Antrum. *O.* Orbital fossa. *s.n.* Septum nasi. *i.t.* inferior turbinate. *m.t.* Middle turbinate.

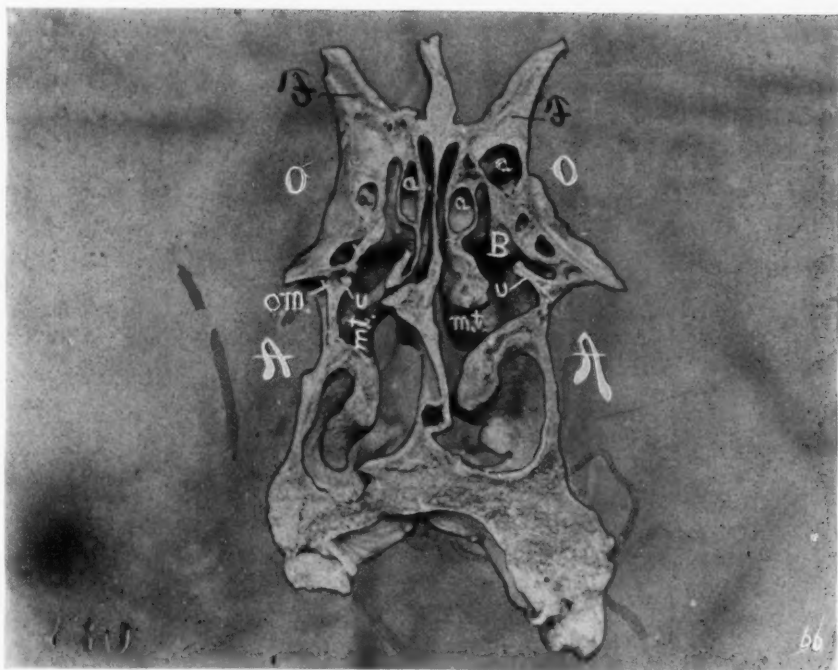
Plate 65.



CORONAL SECTION, ANTERIOR PORTION PASSING THROUGH BOTH OSTIA MAXILLARIA AND THE POSTERIOR ANGLES OF THE FRONTAL SINUSES.

*F.* Frontal sinus. *A.* Antrum. *o.m.* Anterior portion of Ostium maxillare. *U.* Processus Uncinatus. On right side arrow passes through Ostium maxillare into Infundibulum to appear in a cell opposite lachrymal bone, and a second arrow passes through the turbinate fossa to the frontal sinus. *a.a.* Anterior ethmoidal cells opposite lachrymal bone. *i.* Infundibulum. *o.f.* Anterior portion of Ostium frontale. *t.f.* Turbinate fossa. *i.t.* Inferior turbinate. *m.t.* Middle turbinate. *c.* Cells in middle turbinate bone. *s.n.* Septum nasi with spur. *r.* Roof of nasal fossa.

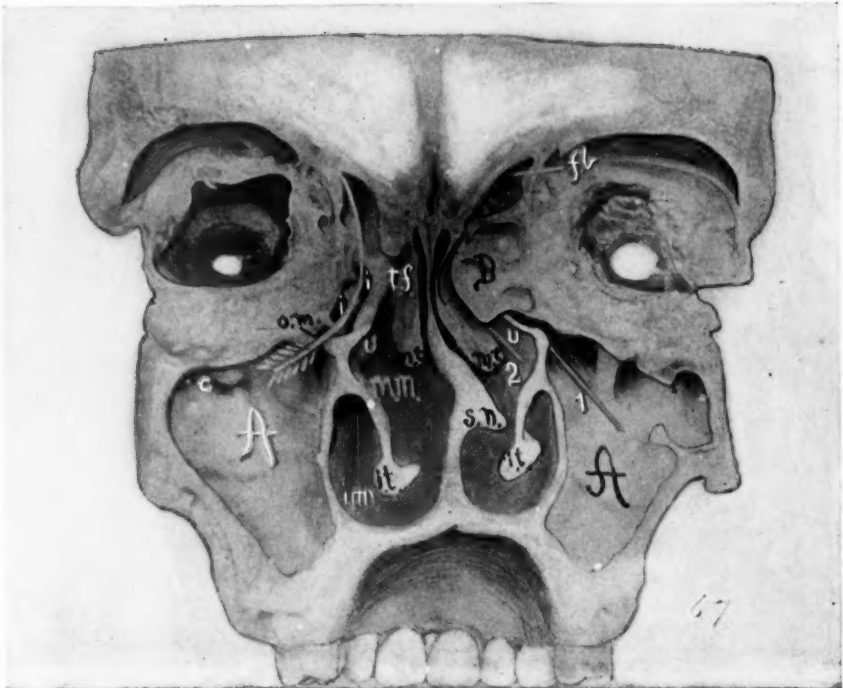
Plate 66.



CORONAL SECTION THROUGH OSTIUM MAXILLARE, POSTERIOR PORTION JUST INCLUDING THE POSTERIOR ANGLE OF FRONTAL SINUS.

*F.* Frontal sinus. *U.* Uncinate process. *B.* Bulla ethmoidalis showing two cells. *o.m.* Posterior portion of Ostium maxillare. *A.* Space occupied by Antrum. *O.* Orbital fossa. *a.a.a.* Anterior ethmoidal cells. *m.t.* Middle turbinate.

Plate 67.

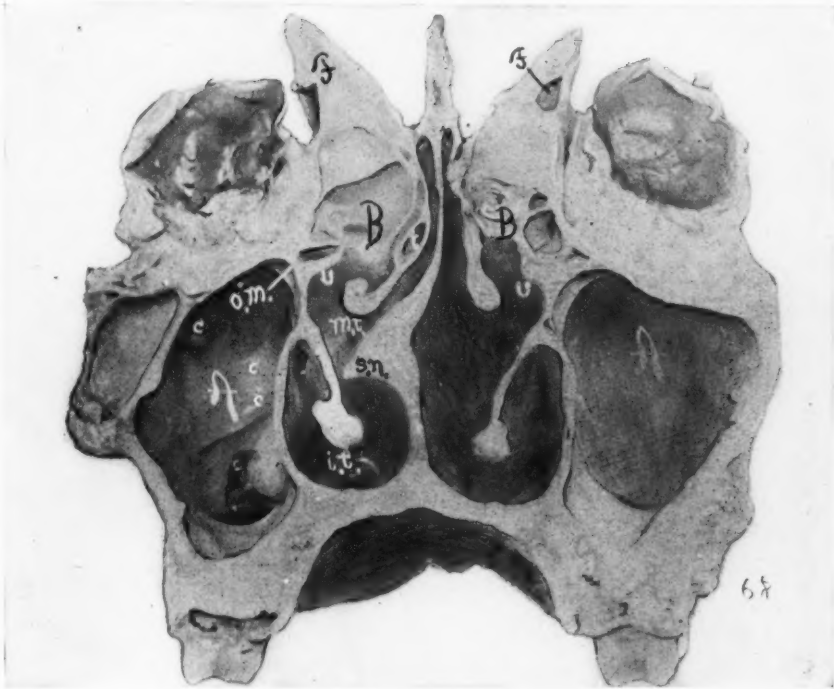


CORONAL SECTION THROUGH OSTIUM MAXILLARE, ANTERIOR PORTION. ON LEFT SIDE BULLA ETHMOIDALIS REMOVED, SHOWING ARROW PASSING THROUGH OSTIUM MAXILLARE AND INFUNDIBULUM TO A LARGE FRONTAL BULLA.

*B.* Large Bulla ethmoidalis on section. *1.* Probe passing from Antrum to a frontal bulla seen on section. *f.b.* Frontal bulla. *2.* Probe passing through turbinates fossa to the frontal sinus. *U.* Processus Uncinatus. *A.* Antrum. *i.m.* Inferior meatus. *m.m.* Middle meatus *t.f.* Turbinate fossa. *i.t.* Inferior turbinate. *m.t.* Middle turbinate. *c.* Cyst in Mucous membrane of Antrum. *o.m.* Anterior portion of Ostium maxillare. *i.* Infundibulum. *s.n.* Septum nasi with large spur. See Plate 68.



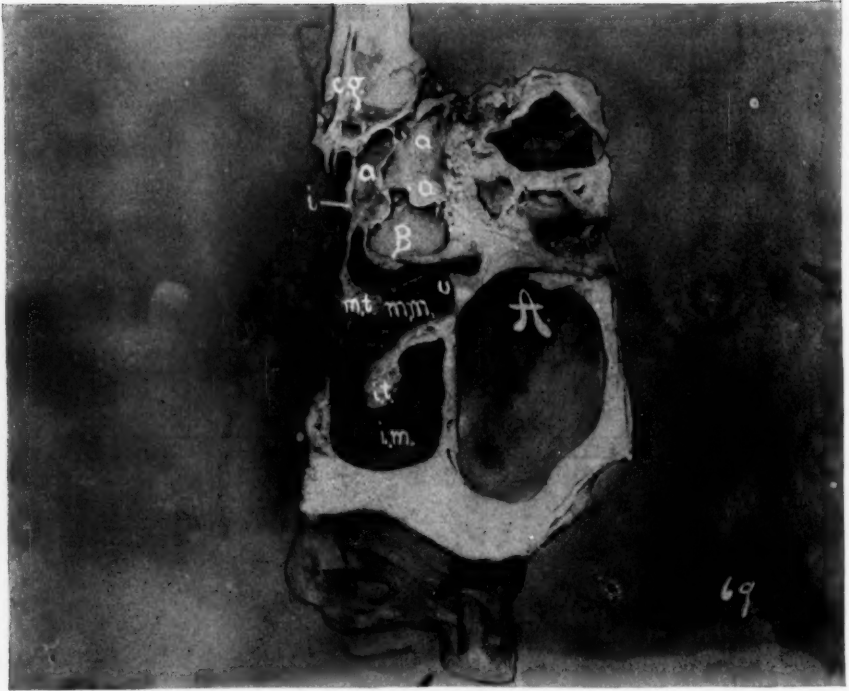
Plate 68.



SAME SPECIMEN, POSTERIOR PORTION.

*A.* Antrum. *o.m.* Ostium maxillare, posterior edge. *c.* Cysts in mucous membrane of Antrum. *U.* Processus Uncinatus. *i.t.* Inferior turbinate. *m.t.* Middle turbinate. *B.* Bulla ethmoidalis on section composed of several cells. *F.* Posterior angles of frontal sinus. *l.* Cell in right turbinate bone. *s.n.* Septum nasi with large spur.

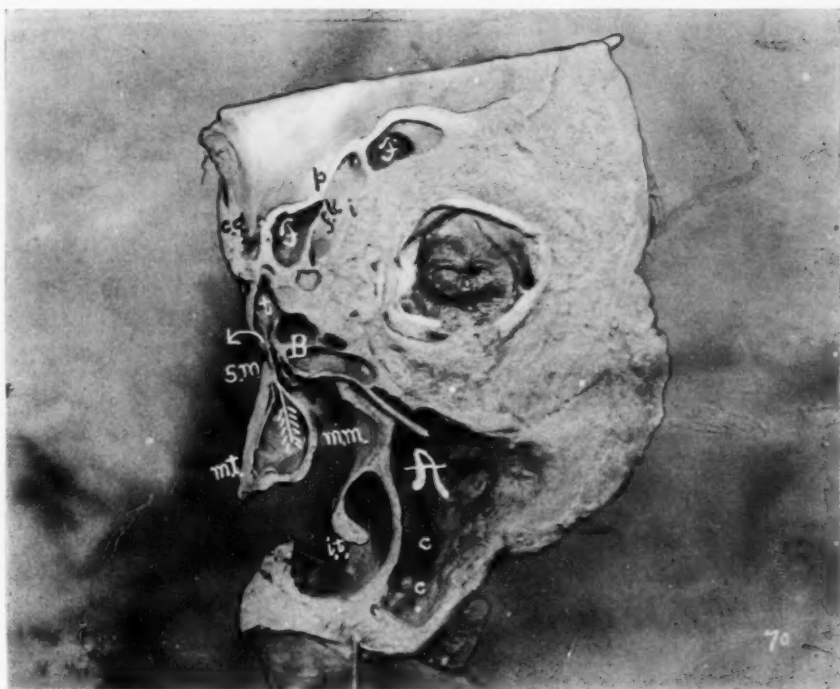
Plate 69.



CORONAL SECTION, POSTERIOR TO OSTIUM MAXILLARE WHICH  
CONTAINS A PROBE.

*A.* Antrum. *B.* Bulla ethmoidalis very broad and overhanging. *i.t.* Inferior turbinate. *m.t.* Middle turbinate. *i.m.* Inferior meatus. *m.m.* Middle meatus. *U.* Processus Uncinatus. *a.a.* Anterior ethmoidal cells. *c.g.* Crista galli. *i.* Internal wall of lateral mass.

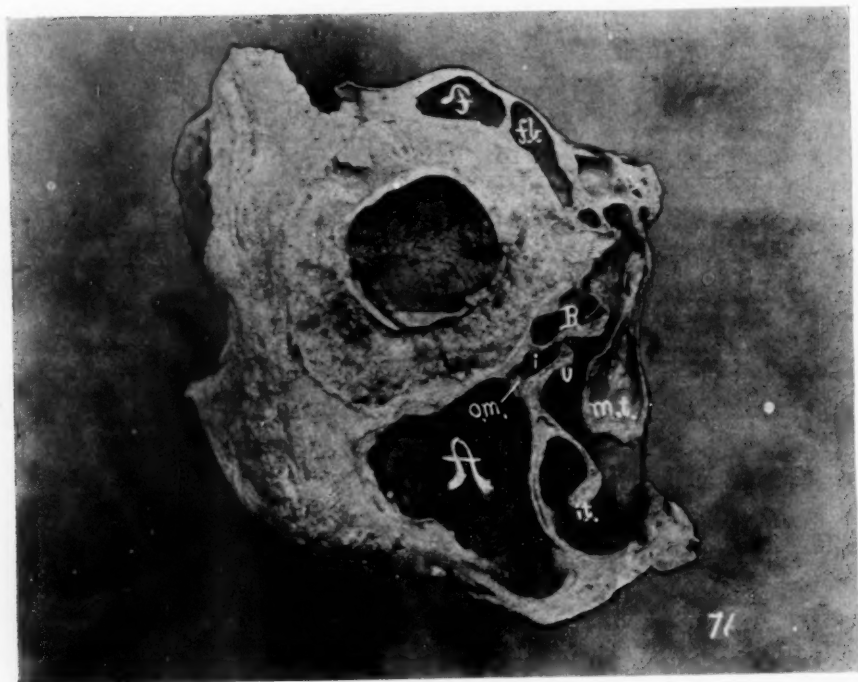
Plate 70.



CORONAL SECTION, ANTERIOR PORTION, THROUGH OSTIUM MAXILLARE AND POSTERIOR PORTION OF A LARGE FRONTAL SINUS;  
SEPTUM OF THE NOSE REMOVED.

*A.* Antrum with small cysts (*c*). Probe passes from Antrum through Infundibulum to frontal sinus. The Infundibulum is converted into a canal by the approximation of the Uncinate process and ethmoid bulla. *B.* Ethmoid bulla containing two cells. *F.F.* Frontal sinus (*p*) posterior wall (*i*) inferior wall. *i.t.* Inferior turbinate. *m.t.* Middle turbinate containing a very large cell which opens into the superior meatus, as shown by arrow. *f.b.* Anterior wall of frontal bulla. *m.m.* Middle meatus. *s.m.* Superior meatus. *c.g.* Crista galli. *l.* Turbinate fossa. See Plate 71.

Plate 71.



POSTERIOR PORTION OF SPECIMEN, FIGURED IN PLATE 70.

*F.* Frontal sinus. *f.b.* Frontal Bulla on section. *A.* Antrum. *o.m.* Ostium maxillare posterior portion. *i.t.* Inferior turbinate. *m.t.* Middle turbinate containing posterior half of cell seen in Plate 70. *U.* Uncinate process. *B.* Bulla ethmoidalis in contact with Uncinate process. *i.* Infundibulum.

to the upward continuation of the bulla ethmoidalis. If there is a naso-frontal canal present, it is completed by this lamina.

This space, bounded internally by the extreme upper end of this turbinate, has been called by the writer, for descriptive purposes solely, the turbinate fossa. (Plates 4, 8, 31, 32, 38, 45, 49, 58, 61, 65, 74, 77.)

*Naso-Frontal Canal.*—The naso-frontal canal is the upward prolongation of the infundibulum, and it is completed by the lamina of bone, as just mentioned. The length of the canal will depend upon the extension downward of this lamina, and will vary from two millimetres to fifteen millimetres. (Plates 11, 12, 38, 40, 41.) The regularity of its course is inconstant, on account of the canal being impinged upon by neighboring cell walls. There may be no true canal whatever, and the passage to the frontal sinus may be through an irregular series of ethmoidal cells. (Plates 7, 9, 52.)

The canal terminates finally in an opening called the ostium frontale, which is located in the nasal portion of the floor of the frontal sinus. (Plates 11, 12, 16, 35, 72, 76.) A passage corresponding to this canal may end blindly in the bulla frontalis, as mentioned above. *If this passage under consideration fails to open into the frontal sinus, it loses its identity as being a naso-frontal canal, consequently in 53 per cent. of these cases there is no naso-frontal canal.*

*In this percentage of cases the frontal sinus opened directly into the turbinate fossa with little or no canal, entirely independent of the infundibulum or any of the cells emptying into it.*

A naso-frontal canal existed in 47 per cent. of the cases.

Openings into the turbinate fossa:

(1) It may be blind in all directions and contain no ostia. (Plate 38.)

(2) Fifty-three per cent. of the frontal sinuses open into it. (Plates 4, 8, 31.)

(3) Two-thirds of the frontal bullæ. (Plate 51.)

(4) Most of the anterior cells on the floor of the sinus anterior to the ostium frontale, and often some of the small

cells just posterior to this ostium, which fill up the posterior frontal angle and belong to the group above the bulla ethmoidalis. These cells also open into the infundibulum and the fissure above this bulla and below the turbinate. The bulla frontalis is nothing more nor less than a very prominent cell belonging to this group, which protrudes well into the frontal sinus. The cells which crowd into the posterior border of the sinus likewise belong to this group.

*To recapitulate the Ethmoidal Cells, we have Two Main Groups.*—(1) Posterior ethmoidal cells,—all cells formed wholly or in part by the ethmoid bone, having their ostia above the line of origin of the inferior ethmoidal turbinate bone. These have not been considered in the foregoing pages.

(2) Anterior ethmoidal cells,—also formed wholly or in part by the ethmoid bone, with their ostia in two grooves corresponding to ethmoidal fissures opening below the inferior ethmoidal turbinate into the middle meatus,—viz.,

(a) Hiatus semilunaris,—the ostium of the infundibulum.

(b) The fissure just under the inferior ethmoidal turbinate, which is continuous above with the turbinate fossa in line with its ostia, if any happen to exist.

These anterior cells have been grouped as follows:

(a) The one or more cells represented by the ethmoid bulla, opening by the ostium of the bulla.

(b) The cells just above, which crowd into the posterior frontal angle, and are in the vicinity of the anterior ethmoidal canal, which runs transversely across their apices. These may empty into the infundibulum, the turbinate fossa, or in the fissure just above the ostium of the bulla.

(c) The group of cells opposite the lachrymal bone, extending around in front of the infundibulum to the nasal process of the superior maxilla, and superiorly often to the floor of the frontal sinus. Most of these cells open into the infundibulum. The cell corresponding to the agger nasi belongs to this group.

*Floor of the Frontal Sinus (Nasal Portion) and the Ostium Frontale.*—We are now able to understand in a few words what structures go to make the nasal portion of the inferior surface of the frontal sinus.

This area is bounded, strictly speaking, by the circumference of the hiatus frontalis, but for surgical purposes it is carried backward into the posterior angle among the ethmoidal cells. (Plates 15, 16.)

Looking into a sinus with a prominent superciliary ridge, the lower part of this anterior surface (to which the ridge belongs) passes backward to the anterior margin of the hiatus frontalis, where there is usually a thick ridge. This is the point of articulation with the nasal process of the superior maxilla. (Plates 11, 51, 56.)

Keeping to our strict anatomical lines, this somewhat horizontal surface is a portion of the anterior surface, rendered thus on account of a prominent bulging forward (superciliary ridge). This peculiarity does not appear when the anterior wall is flattened. (Plates 24, 29, 49.)

Just posterior to this ridge we come to rounded eminences, which extend outward and backward, and are made by cells described as opposite the lachrymal bone, and extending towards the nasal process of the superior maxilla. (Plates 9, 57, 72, 74, 76, 77, 79.)

Posterior and internal to the apices of these cells, quite close to the frontal septum, is an opening called the ostium frontale. The ostium is generally well back towards the posterior angle. (Plates 11, 12, 16, 37, 42, 65, 72, 76.) Posterior to the ostium we come at once to the apices of the cells represented as filling the posterior angle, which often are of sufficient prominence to overhang and obscure the ostium frontale. The bulla frontalis (Plates 37, 51, 77), if present, appears at this angle often obscuring the ostium, and extending laterally along the posterior border for a variable distance.

Now and then diverticula are seen to extend down into the nasal process of the frontal bone (Plates 11, 26, 37), and

less frequently backward into the crista galli. (Plates 10, 26.) Diverticula occasionally run down vertically into the infundibulum, independent of the naso-frontal canal.

The sagittal measurement of this surface is not often more than ten millimetres, but in all cases it can be increased surgically with but little element of danger, by curetting the cells in the posterior angle. Laterally this floor corresponds to the width of the hiatus frontalis. Surgically more space is easily gained internally by breaking through the upper end of the inferior ethmoidal turbinate towards the septum nasi, inferior to the lamina cribrosa. (Plates 20, 59, 65.)

*Ostium Frontale.*—Little remains to be said concerning this ostium. It may be oval, circular, or linear with its longest measurement from two millimetres to eight millimetres. It is usually oval and about three millimetres long.

The most common location is well towards the posterior limit of the floor of the sinus, close to the frontal septum. Each sinus has its ostium. One exception has been noted. (Plates 55, 67, 68.)

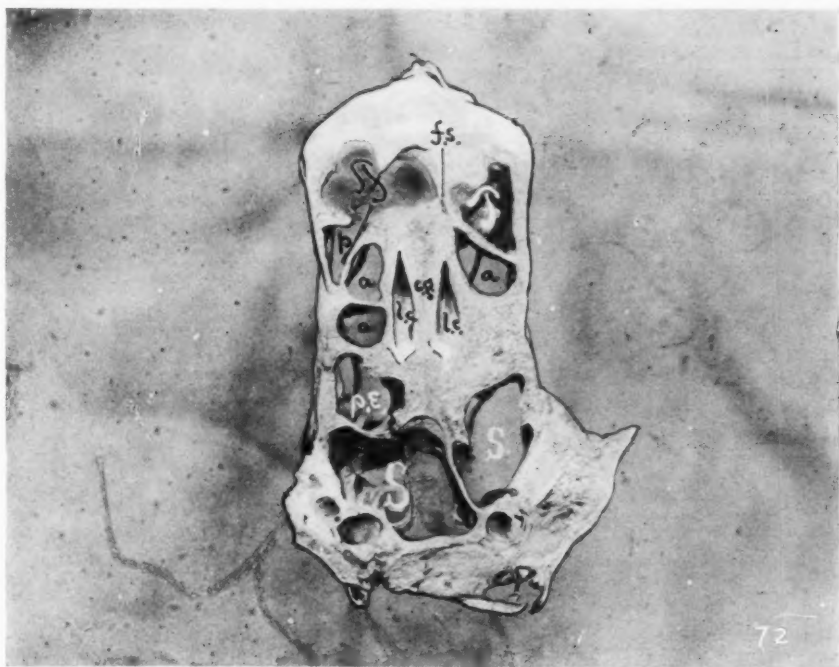
Its methods of opening into the nasal cavity have been considered.

*Lining of the Frontal Sinus.*—The mucous membrane which lines the frontal sinus does not differ in essential characteristics from that found in the other accessory nasal cavities. In general, it is somewhat thinner than that found in the antrum of Highmore, and more easily detached from the bony wall of the sinus.

In section, it presents the following layers: Facing the cavity of the sinus is a layer of ciliated columnar epithelium, between the cells of which are interspersed a variable number of goblet cells. The cilia produce a current towards the ostium frontale. Underneath the epithelium is a layer of loose connective-tissue cells, between the meshes of which are glands and round cells. This layer is capable of enormous increase in thickness, in consequence of inflammatory processes, by the addition of the serous element and leucocytes from the blood. The cavity of small sinuses may thereby be



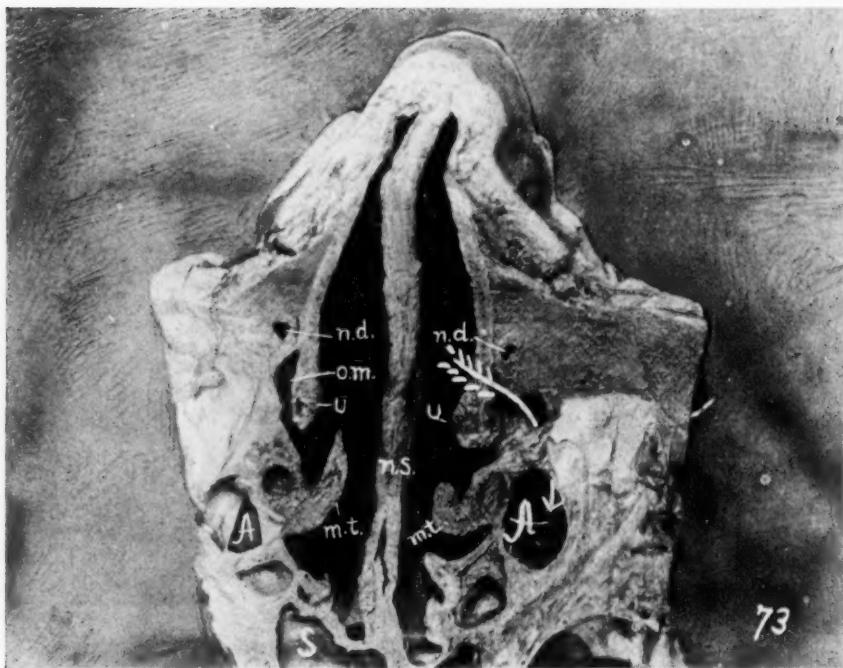
Plate 72.



HORIZONTAL SECTION AT THE LEVEL OF THE LAMINA CRIBROSA SHOWING A CONSIDERABLE PORTION OF THE FLOOR OF THE LEFT FRONTAL SINUS.

*F.* Frontal sinus. *l.c.* Lamina cribrosa, a small portion on either side of the Crista galli (*c.g.*). *f.s.* Septum between the frontal sinuses. *p.* Posterior angle of left frontal sinus. *a.a.a.* Some anterior ethmoid cells. *S.* Sphenoidal sinus, septum to right of median line. *p.e.* Posterior ethmoid cell.

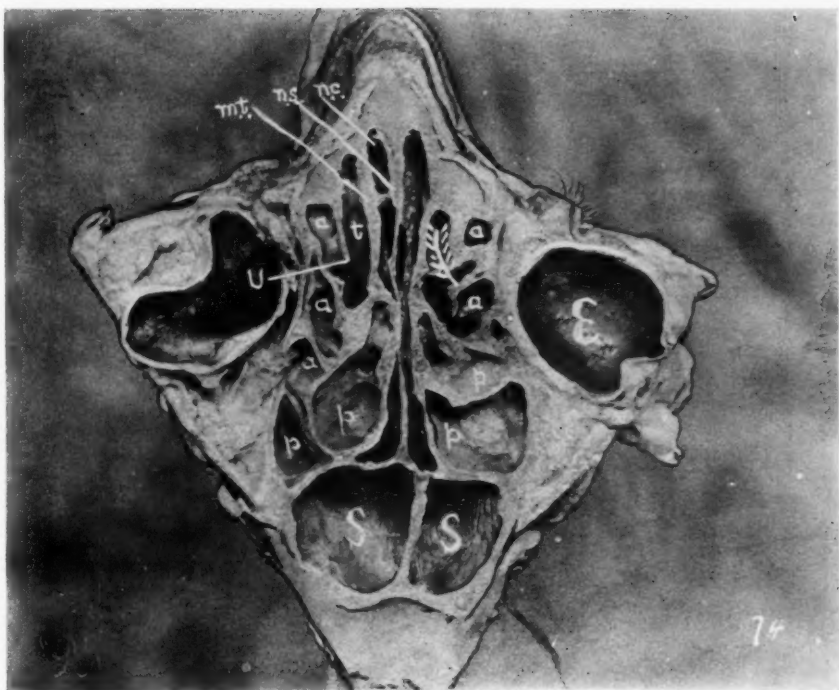
Plate 73.



HORIZONTAL SECTION JUST ABOVE THE OSTIUM MAXILLARE LOOKING  
DOWNWARD.

*n.s.* Nasal septum. *A.* Apex of Antrum. *om.* Ostium Maxillare. *U.* Processus Uncinatus. *m.t.* Portion of middle turbinate. *S.* Left sphenoidal sinus. Arrow passes down right Infundibulum through Ostium maxillare to Antrum.

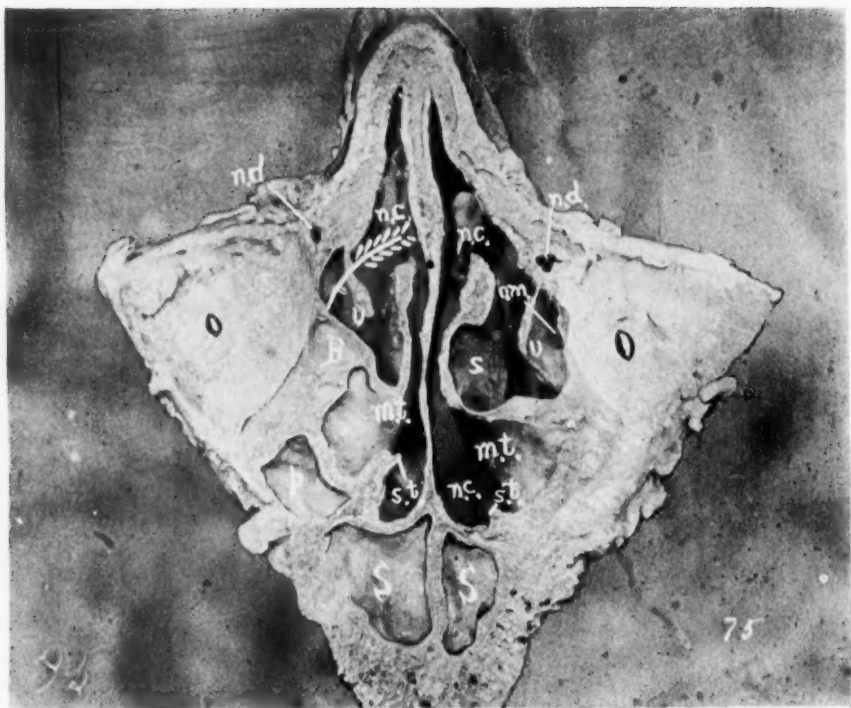
Plate 74.



HORIZONTAL SECTION JUST BELOW THE LAMINA CRIBROSA LOOKING DOWNWARD,  
SHOWING NUMEROUS ANTERIOR AND POSTERIOR ETHMOIDAL CELLS.

*a.a.a.* Anterior ethmoidal cells. *p.p.p.* Posterior ethmoidal cells. *U*. Upper extremity of Uncinate process. *mt.* Anterior extremity of middle turbinate meeting the nasal process of the superior maxilla in front. *t.* Turbinate fossa. *S.* Sphenoidal sinus. Arrow passing down Infundibulum to Antrum. *n.s.* Nasal septum. *E.* Eyeball. *n.c.* Nasal cavity.

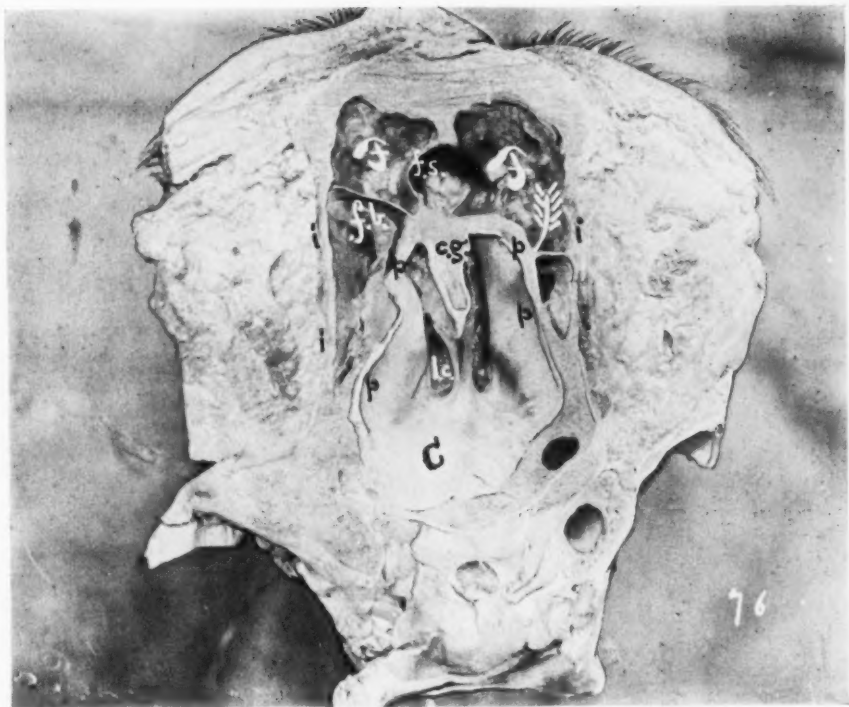
Plate 75.



HORIZONTAL SECTION JUST ABOVE OSTIUM MAXILLARE LOOKING DOWNWARD  
THROUGH THE MIDDLE TURBINATE SHOWING ITS UPPER HORIZONTAL  
PORTION. ARROW PASSES DOWN LEFT INFUNDIBULUM  
THROUGH OSTIUM MAXILLARE TO ANTRUM.

*o.m.* Ostium Maxillare. *U.* Uncinat process. *n.d.* Nasal duct. *n.c.* Nasal cavity. *m.t.* Middle turbinate, showing its horizontal portion. *s.t.* Superior turbinate, posterior extremity. *O.* Orbital surface of Antrum. *S.* Sphenoidal sinus. *s.* External concave surface of middle turbinate showing sinus turbinalis. *B.* Bulla ethmoidalis (lower portion). *p.* Posterior ethmoid cell.

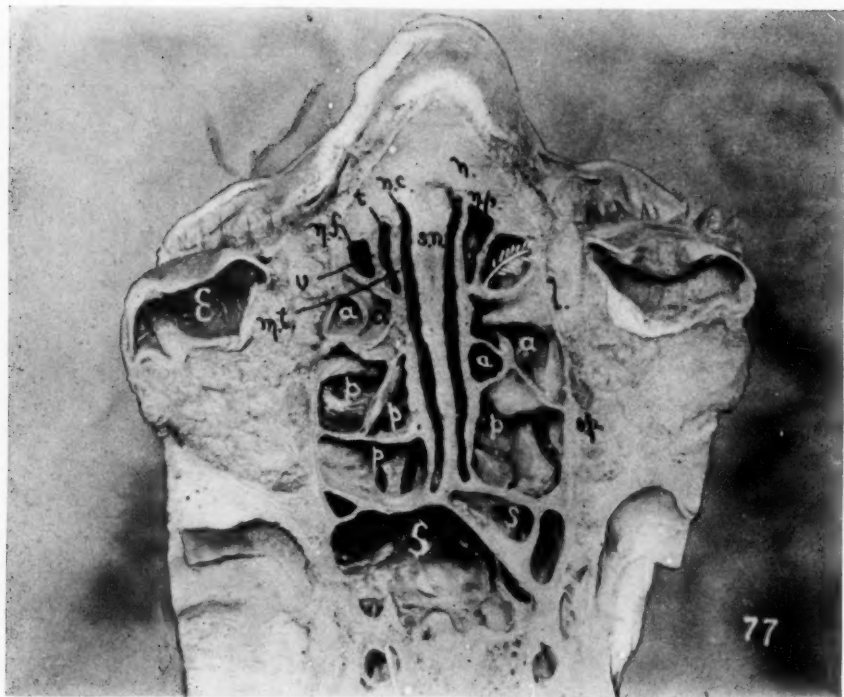
Plate 76.



HORIZONTAL SECTION JUST ABOVE THE LAMINA CRIBROSA SHOWING FLOOR OF FRONTAL SINUS.

*f.* Frontal sinus. Arrow passing through right Ostium frontale. *f.b.* Frontal Bulla. *i.* Inferior wall of frontal sinus, corresponding to inferior lamina of frontal bone. (Orbital portion). *p.* Posterior wall of frontal sinus corresponding to the superior lamina of the orbital portion of the frontal bone. *c.g.* Crista galli. *f.s.* Septum between the frontal sinuses. *l.c.* Lamina cribrosa. *C.* Anterior cranial fossa.

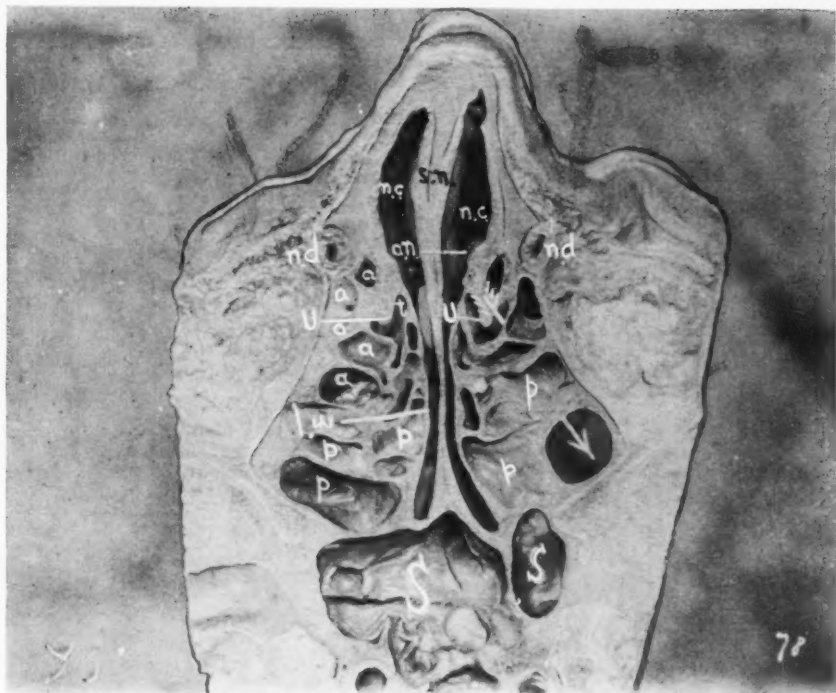
Plate 77.



HORIZONTAL SECTION JUST BELOW LAMINA CRIBROSA, LOOKING DOWNWARD,  
SHOWING NUMEROUS ANTERIOR AND POSTERIOR  
ETHMOIDAL CELLS.

*s.n.* Septum nasi. *a.a.a.* Some anterior ethmoidal cells. *p.p.p.* Some posterior ethmoidal cells. *n.f.* Naso-frontal canal. *t.* Apex of turbinate fossa. *n.c.* Nasal cavity. *S.* Sphenoidal sinus with septum far to the right of median line. *U.* Upper extremity of uncinate process. *m.t.* Anterior upper extremity of middle turbinate. *E.* Eyeball. *n.* Nasal bone. *n.p.* Nasal process of superior maxilla. *l.* Lachrymal bone. *o.p.* Os Planum. Arrow passes down into right naso-frontal canal from right frontal sinus.

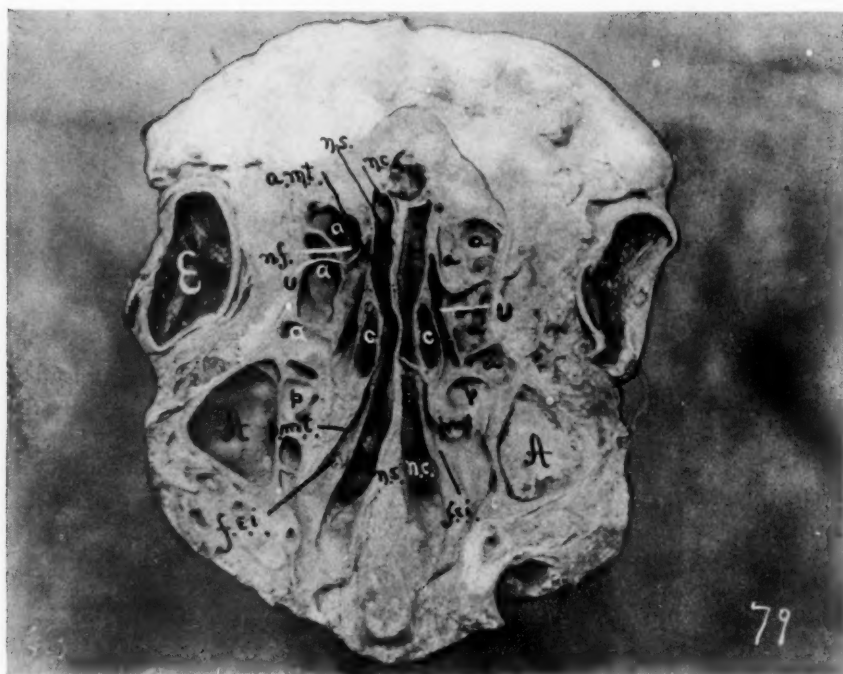
Plate 78.



HORIZONTAL SECTION OF SAME SPECIMEN AT A LOWER LEVEL THAN PLATE 77,  
LOOKING DOWNWARD.

*s.n.* Nasal septum. *n.c.* Nasal cavity. *n.d.* Nasal duct. *u.* Processus Uncinatus. *i.* Infundibulum on right side through which the arrow seen in Plate 77, continues to the antrum, which has been exposed on the right side only. *a.a.a.* Some anterior ethmoidal cells, numerous opposite left lachrymal bone. *l.* Turbinate fossa. *a.n.* Agger Nasi. *l.w.* Internal lateral wall of labyrinth continued anteriorly as the middle turbinate bone. *S.* Sphenoidal sinus. *p.p.p.* Posterior ethmoidal cells.

Plate 79.

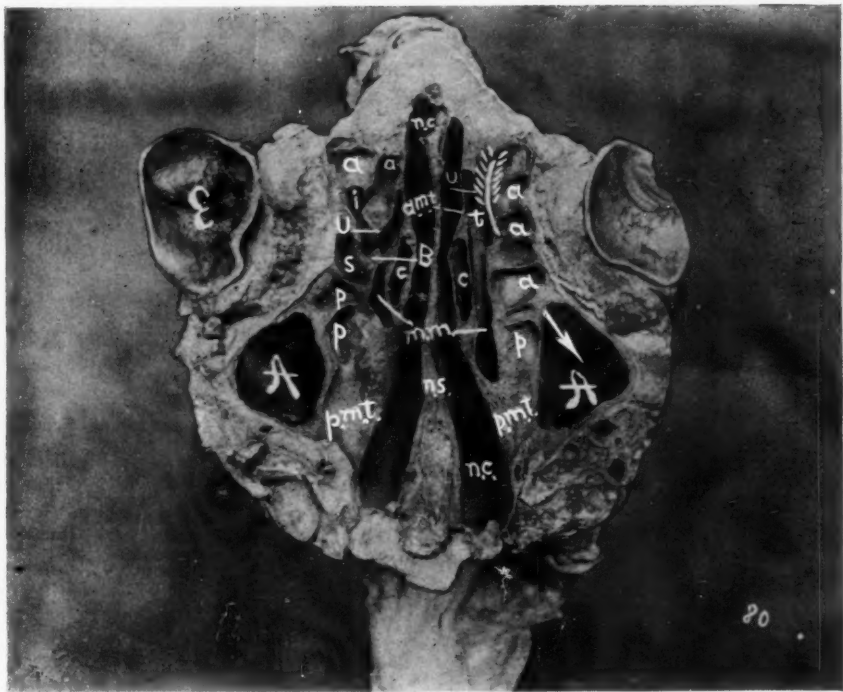


HORIZONTAL SECTION, LOOKING UPWARD, MADE AT A LEVEL SO AS TO CUT THE APICES OF THE ANTRA.

*n.c.* Nasal cavity. *n.s.* Nasal septum. *A.* Apex of Antrum. *E.* Eyeball. *a.m.t.* Anterior extremity of middle turbinate. *p.m.t.* Posterior extremity of middle turbinate. *c.* Cells in middle turbinate. *a.a.a.* Some anterior ethmoidal cells. *p.p.* Posterior ethmoidal cells. *n.f.* Naso-frontal canal. *U.* Processus Uncinatus. *f.e.i.* Fissura ethmoidalis inferior, with free edge of superior turbinate toward the medium line. See plate 80.



Plate 30.



HORIZONTAL SECTION, OTHER HALF OF PLATE 79, LOOKING DOWNWARD.

ARROW PASSES DOWN NASO-FRONTAL CANAL TO ANTRUM.

*A.* Antrum. *E.* Eyeball. *U.* Processus Uncinatus. *a.m.t.* Anterior portion of middle turbinate. *p.m.t.* Posterior portion of middle turbinate showing its horizontal aspect. *i.* Infundibulum. *B.* Bulla ethmoidalis on section. *m.m.* Middle meatus. *t.* Turbinate fossa. *c.* Cell in middle turbinate. *a.a.a.* Some anterior ethmoid cells. *p.p.p.* Some posterior ethmoid cells. *s.* Sinus of the Bulla ethmoidalis on the left side. *n.c.* Nasal cavity. *n.s.* Nasal septum.

Plate 81.



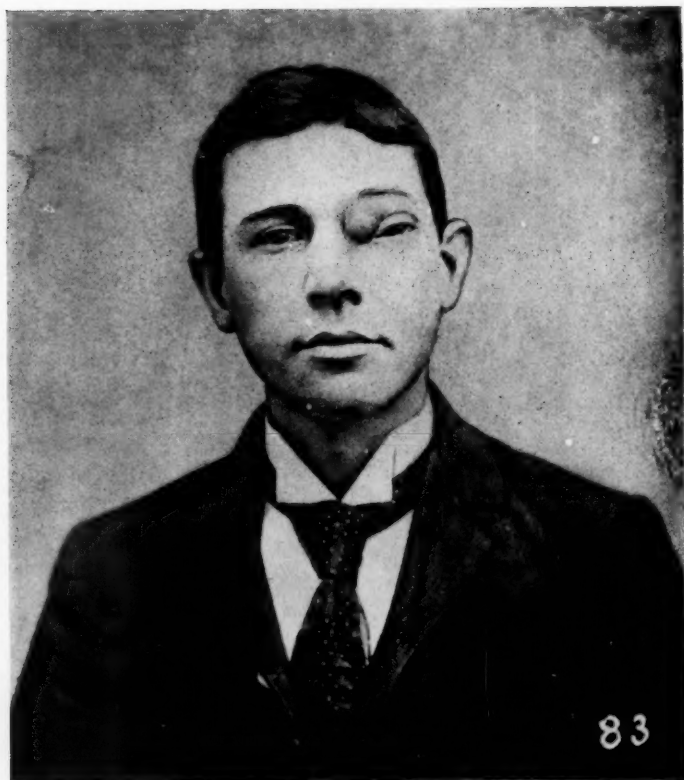
1. SHOWING LINE OF INCISION FOR OSTEO-PLASTIC OPERATION, PART OF WHICH IS CONCEALED BY THE EYEBROW. IT FOLLOWS, IN A MEASURE, THE NATURAL WRINKLES OF THE SKIN. 2. INCISION FOR APPROACHING THE INFERIOR WALL OF THE FRONTAL SINUS AND ANTERIOR ETHMOIDAL CELLS.

Plate 82.



SHOWING BONEFLAP TURNED DOWN, AND FRONTAL SINUS EXPOSED. POSTERIOR WALL OF SINUS TO BE SEEN IN THE BACKGROUND.

Plate 83.



MUCOCELE INVOLVING LEFT FRONTAL SINUS. EYE DISLOCATED DOWNWARD AND OUTWARD. SEE CASE 4.

Plate 84.



COMBINED EMPYEMA OF THE FRONTAL SINUS, THE ANTRUM OF HIGHMORE, AND  
THE ANTERIOR ETHMOID CELLS. SEE CASE 3.

Plate 85.



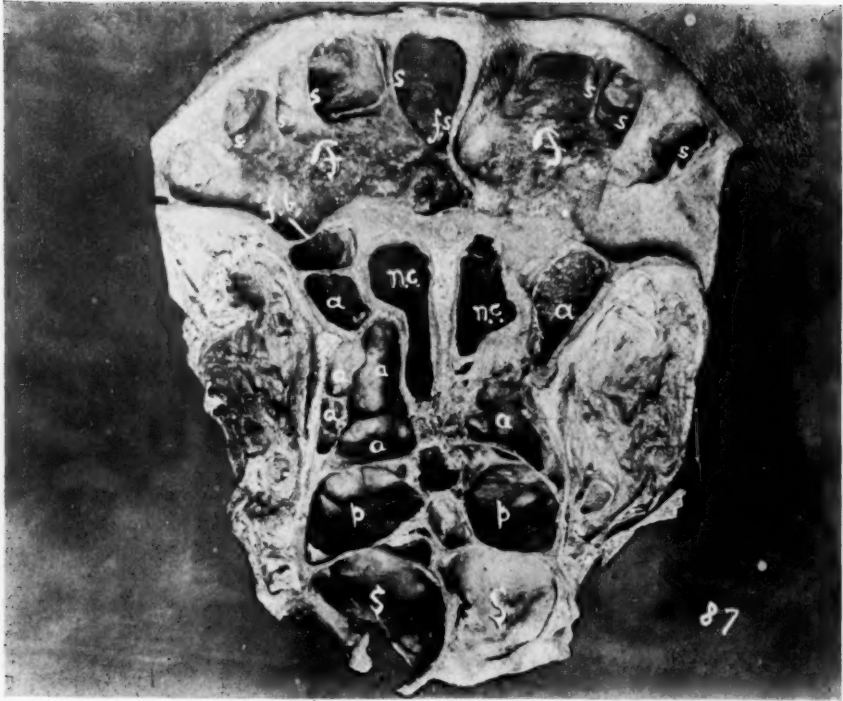
DOUBLE FRONTAL PNEUMATOCELE, REPORTED BY WARREN, FIGURED BY  
ALBERT; LEHRBUCH DER CHIRURGIE.

Plate 86.



MUCOCELE. ALBERT, LEHRBUCH DER CHIRURGIE.

Plate 87.

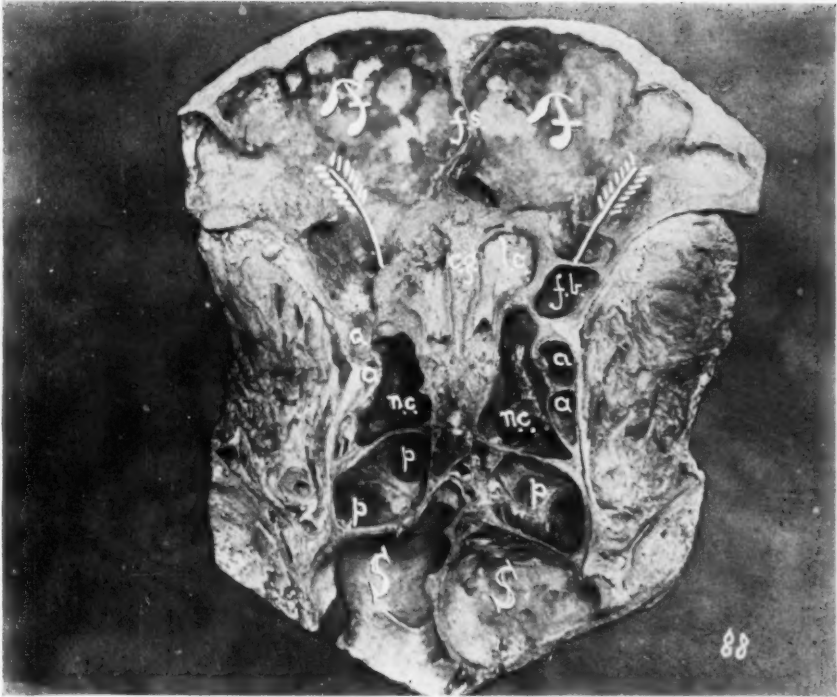


HORIZONTAL SECTION JUST ABOVE THE LEVEL OF THE LAMINA CRIBROSA.  
UPPER HALF OF SECTION, LOOKING INTO LARGE FRONTAL SINUSES  
CONTAINING NUMEROUS SEPTA.

*F.* Frontal Sinus. *f.s.* Inter-frontal septum. *s.* Irregular septa. *f.b.* Frontal bulla. *a.a.a.* Anterior ethmoid cells. *p.p.p.* Posterior ethmoid cells. *S.* Sphenoidal sinus. *n.c.* Nasal cavity. See Plate 88.



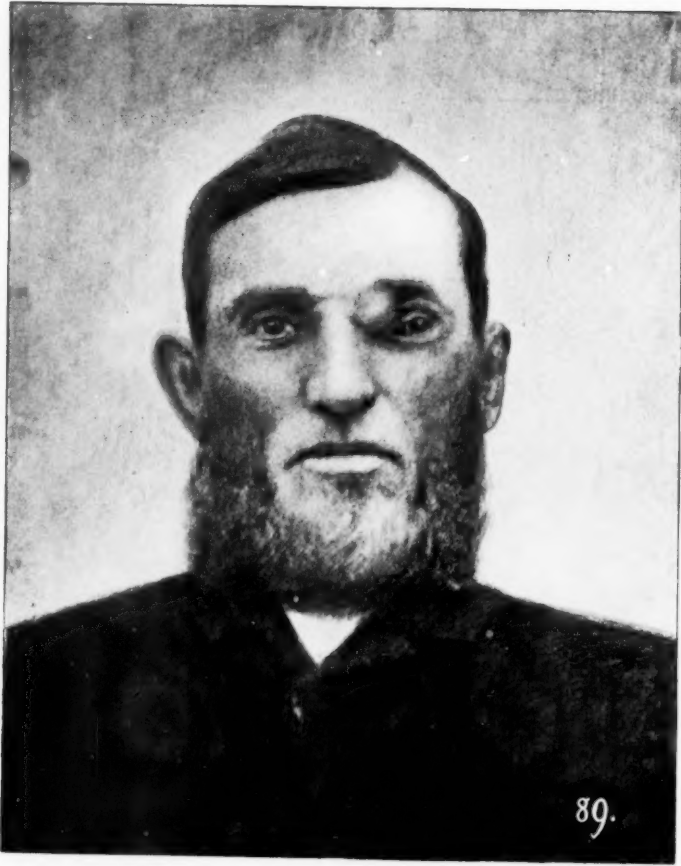
Plate 88.



LOWER HALF OF SPECIMEN FIGURED IN PLATE 87, LOOKING DOWNWARD,  
SHOWING THE FLOOR OF LARGE FRONTAL SINUSES. ARROW  
THROUGH OSTIUM FRONTALE.

*F.* Frontal sinus. *f.s.* Inter-frontal septum. *l.c.* lamina cribrosa. *c.g.* Crista galli. *f.b.* Frontal bulla. *a.a.a.* Anterior ethmoid cells. *p.p.p.* Posterior ethmoid cells. *S.* Sphenoidal sinus. *n.c.* Nasal cavity.

Plate 89.



DR. PILCHER'S CASE OF EMPYEMA OF THE FRONTAL SINUS.

obliterated, and the consequent pressure gives rise to excruciating pain. The lining of the frontal sinus contains fewer glands than that of the antrum, and their distribution over the surface is unequal.

Underneath this loose layer we come to a rather dense basement layer, composed of compact fibrous connective-tissue cells. This is next to the bone and serves as a periosteum. It is easily detached except in the vicinity of the ostium frontale, where it is continuous, directly or indirectly, as the case may be, with the mucous membrane of the nasal cavity. Delicate vessels, passing between the membrane and the sinus wall, help retain these structures in approximation.

The blood-supply of the sinus is derived from branches of the sphenopalatine and anterior ethmoidal arteries, and to a slight degree from arteries of external origin, just mentioned, which pass through minute foramina in the sinus walls.

The nerve-supply is mainly through the nasal branch of the ophthalmic division of the trifacial nerve. (Inzani.)

*A Few Anatomical Facts of Surgical Importance.*—It will be obvious that in operating upon the floor of the sinus, in the radical operation for empyema of the frontal sinus or of the anterior ethmoidal cells, the curette should be directed downward, inward, or backward; that externally we should avoid entering the orbital fossa through the lachrymal bone or os planum; that the posterior surface of the sinus and the region of the lamina cribrosa should be carefully avoided on account of the liability of entering the cranial cavity. Anteriorly the curette can be used with impunity against the posterior border of the nasal process of the superior maxilla.

The posterior surface possesses a curve which is very constant for each case (Plate 51), and any sudden interruption in its contour towards the posterior angle is generally due to cellular laminæ, convex anteriorly, and it will be safe to puncture these downward and inward.

The question of probing the frontal sinus and its practicability will be considered in Part II. Suffice it to say here

that it is a comparatively easy matter on the cadaver to pass a probe from the sinus into the nasal cavity. On the other hand, with the nasal fossæ divided by a median sagittal section and the septum removed, it is often easy to enter the sinus, sometimes impossible, and often doubtful as to where the probe has gone. Removal of the upper anterior portion of the turbinate is of great assistance. Results obtained by passage of the probe in the natural state, by the anterior nares, are rarely to be trusted with absolute certainty. Granting that the probe enters for a considerable distance, if we are fortunate enough to pass the many obstructions and avoid the numerous ostia in our way, even then we can never know whether the end of our instrument is only in a frontal bulla or a single compartment of the sinus. The direct course to the sinus is usually interrupted by prominences or septa, and the ostium frontale may not face properly for the reception of the probe or canula. Attempts to force the probe up into the sinus generally result in injury to the parts.

The relation of the ostium maxillare to the infundibulum has been considered in sufficient detail. In cases possessing a naso-frontal canal, it is not unusual to be able to pass a *straight* probe from the frontal sinus to the antrum, the probe passing successively the ostium frontale, naso-frontal canal, infundibulum, and ostium maxillare. A slightly curved probe can be made to do this frequently.

Where the ostium frontale opens into the turbinate fossa (53 per cent. of the 250 cases examined) the uncinate process is the principal determining factor as to whether a slightly curved probe can be made to enter the antrum. This could be done in numerous instances, and the course of the probe would be as follows: Ostium frontale, turbinate fossa, hiatus semilunaris, infundibulum, and ostium maxillare. In these cases polypi and hypertrophies easily tend to direct exudate from the frontal sinus into the infundibulum, and thence into the antrum. At the same time, it is possible to conceive that such obstruction could prevent drainage into the antrum.

It will be observed that the ostia of the various groups of anterior ethmoidal cells are distributed along the route from the frontal sinus to the antrum, and in very intimate relation thereto. Both the clinical and anatomical evidence is such that the involvement of these cells, in suppurative processes, may be either of primary or secondary connection with similar processes in the frontal sinus.

These considerations will be more fully discussed in Part II.

(TO BE CONTINUED.)

## EDITORIAL ARTICLE.

### BUTLIN ON RESULTS OF OPERATIONS FOR CAN- CER OF THE TONGUE.<sup>1</sup>

IN an address before the Hunterian Society of London, the author analyzes the results of operations for cancer of the tongue in 102 patients; fifty-three of these were hospital cases, forty-nine occurred in his private practice. He has been able to trace all but seven of the whole number, and gives the results as follows:

TABLE I.—HOSPITAL CASES.

	Cases.
Died of operation . . . . .	9
Lost sight of . . . . .	7
Recurrence <i>in situ</i> . . . . .	8
Affection of glands without recurrence . . . . .	16
Died later, cause unknown (probably cancer) . . . . .	4
Well within three years after operation . . . . .	2
Well more than three years after operation . . . . .	7
	—
Total . . . . .	53

TABLE II.—PRIVATE CASES.

	Cases.
Died of operation . . . . .	1
Recurrence <i>in situ</i> . . . . .	10
Affection of glands without recurrence . . . . .	12
Died of other causes than cancer of the tongue within three years . . . . .	4
Well within three years after operation . . . . .	9
Well or died of other causes more than three years after operation . . . . .	13
	—
Total . . . . .	49

<sup>1</sup> Henry T. Butlin, F.R.C.S. (Lond.); British Medical Journal, February 26, 1898.  
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The heavy mortality attending the hospital operations was due to the greater extent of the disease and the bad condition of many of this class of cases. The larger percentage of cures among the private patients is explained by the comparatively early period of the disease at which the operation was performed. In the cases of cure, the disease in the large majority of them was situated in the anterior two-thirds of the tongue. His experience shows, however, that even when the disease is far back on the dorsum of the tongue or along the border in the neighborhood of the anterior pillar of the fauces, some cases can be treated with success, provided the disease has not invaded the tonsillar and neighboring regions. In none of the cured private cases were any of the lymphatic glands removed, either at the time of the operation on the tongue or afterwards, but of the seven cured hospital cases enlarged glands were detected and were removed. The whole tongue was removed in sixteen cases, with results as follows:

TABLE III.—REMOVAL OF ENTIRE TONGUE.

	Cases.
Died of operation . . . . .	4
Died very soon of other causes . . . . .	2
Recurrence <i>in situ</i> . . . . .	5
Affection of glands without recurrence . . . . .	1
Lost sight of . . . . .	3
Well more than three years after operation . . . . .	1
Total . . . . .	16

This question of the removal of the entire tongue is one of considerable importance. The operation is much more dangerous than the removal of the fore part or of one-half of the tongue. The patient is cruelly maimed, his speech is very defective; he has difficulty in taking solid food; he suffers from the collection of mucus and saliva in the mouth; and, if his occupation depends on speech, even in a moderate degree, he is forced to abandon it. The relation, therefore, of the removal of a part of the tongue to the removal of the entire tongue is widely dif-

ferent from the relation of the removal of a part of the breast to the removal of the entire breast. The latter is a disfigurement, the former is a serious mutilation. There is ample proof that removal of a portion of the tongue is sufficient to cure a considerable percentage of patients, and to save a much larger percentage from recurrence of the disease within the mouth. The operation of the removal of the entire tongue as a routine operation can only be justified by proving, as far as it is capable of proof, that a very considerable proportion of the persons who suffer from recurrence in the mouth would have been preserved from that recurrence had the entire tongue been removed. Out of some sixty-six patients in whom local recurrence might have taken place, it was observed only in eighteen,—little more than one-quarter of the total number. In five of the eighteen the entire tongue had been removed, and in five other cases recurrence took place in the floor of the mouth or in the anterior half arch of the palate, or in some part which would not have been more freely dealt with had the entire tongue been removed. In two instances the disease was found during the operation to extend back to the epiglottis, without producing obvious induration of the back part of the tongue, so that the incision, which was as far back as practicable, was actually through the disease. In one patient an error of judgment led to the removal of too small a portion of the tongue, so that there only remain five cases in which it is possible that removal of the entire tongue would have done more for the safety or comfort of the patient than was done by the smaller operation.

Butlin always aims at removing the cancer with three-quarters of an inch of apparently healthy tissues around it in every direction. Where the disease is on the border of the tongue the routine practice is to remove half the tongue to an inch behind the margin of the disease. In cases in which the disease is near the tip or fore part of the dorsum, the fore part of the tongue is removed. The results show how much can be done by such an operation in suitable cases.



TABLE IV.—SUCCESSFUL CASES.

Duration since operation:

1 to 2 years . . . . .	6	} More than 3 years, 20 patients.
2 to 3 years . . . . .	4	
3 to 4 years . . . . .	5	
4 to 5 years . . . . .	3	
5 to 6 years . . . . .	4	
6 to 7 years . . . . .	1	
7 to 8 years . . . . .	1	
8 to 9 years . . . . .	2	
9 to 10 years . . . . .	1	
10 years . . . . .	1	
12 years . . . . .	2	
Total . . . . .	30 cases.	

The author calls attention to the frequency with which successful local extirpation of tongue cancer is spoiled by secondary affection of glands that may have appeared normal at the time of operation. He thinks that while about 70 per cent. of the cases can be so successfully treated by operation that no recurrence *in situ* will occur, between thirty and forty of these seventy will die of later disease in the glands of the neck. As to the proposition to defer removal of cervical glands until some enlargement of them can be detected, he avers that by the time any perceptible enlargement of the glands has occurred, the affected glands are already so fixed and so numerous that it is useless to attempt to remove them. The difficulty of discovering the glands through the overlying structures sufficiently early to remove them with success has been demonstrated in many of the cases under his care. He has found that sometimes the affected glands are behind the angle of the jaw; sometimes they are in the floor of the mouth, behind the symphysis of the lower jaw; sometimes they are half-way down the neck, on a level with the thyroid cartilage. So great is this irregularity that no particular group of glands presents itself as the one to be removed in each case. The lymphatics of the tongue may pass through one or

more of four groups of glands: (1) The submental group, which lie beneath the floor of the mouth behind the lower jaw; (2) the submaxillary, some of which actually lie in the substance of the salivary gland; (3) the parotid; and (4) the carotid, which lie over the course of the carotid artery and particularly over the bifurcation of the common carotid.

Speaking generally, it may be said that, although the lymph from the anterior portion of the tongue does occasionally pass, directly or indirectly, through the parotid group of glands, it does so only rarely, and the rule is that all the lymphatics from the anterior half of the tongue, whether from the dorsum, the border, or the under aspect, pass through one or more of the three anterior groups of glands. This is the more fortunate because the anterior half or two-thirds of the tongue is much more subject to cancer than the posterior part; also because there is much greater uncertainty respecting the relation of the parotid group of glands than there is respecting the relation of the three other groups. So far as the majority of cancers of the tongue are concerned, especially of the cancers which can be removed, so that they are not likely to recur within the mouth, it may be foretold that they will inoculate one or more of the three anterior groups of glands, particularly the submaxillary and carotid groups. The removal of these three groups, then, would offer a reasonable prospect of preserving the patient, in any given case, from glandular affection. And if, in addition, the parotid glands, or those of them most likely to be affected, could be removed during the same operation, an increased prospect of success would be afforded. With this in mind Butlin has carried out on many occasions during the last eighteen months or two years, an operation which removes all the contents of the great anterior triangle of the neck, including the submaxillary salivary gland. And, although he has not yet operated on a sufficient number of cases, and time enough has not yet elapsed to allow the routine to be judged, the results

have already been so good as to encourage an extended trial of the method of operating.

The anterior triangle is thoroughly exposed by an incision about seven inches long on the anterior border of the sternomastoid muscle from the mastoid process to below the thyroid cartilage, and a second incision from the symphysis of the lower jaw to the first incision about the upper level of the thyroid cartilage, and raising up the two triangular flaps which are thus mapped out. The dissection is commenced from the apex of the triangle, below, and carried upward. The large vessels are exposed for a considerable distance. The vessels which are cut are clamped before, or as they are divided; and, finally, the submaxillary salivary gland is taken out. A very careful dissection is made of the triangle, so that the connective tissue and glands are all taken out in one continuous mass. Search is made between the muscles in front for one or two deeper-seated lymphatic glands, and the glands in front of the parotid gland and about the angle of the jaw are removed with the other contents of the triangle. The submental and parotid glands are not so easily and certainly removed *en masse* in this operation as the submaxillary and carotid groups. Both the latter groups are very readily removed, and require no special search to be made for them. This is fortunate, because they contain the lymphatic glands, which are by far the most likely to be affected. The dissection occupies from an hour to an hour and a quarter, but the wound heals very rapidly, so that patients have been able to go out of doors eight or ten days after the operation. At first he performed it at the same time that he removed the affected portion of the tongue. But experience taught him that this is too hazardous. The disease of the tongue should be first removed; and, when the patient has had time (three or four weeks) to recover from this operation, and can take food well, the removal of the contents of the anterior triangle may be undertaken without fear.

## REVIEWS OF BOOKS.

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ABDOMINAL SURGERY. By J. GREIG SMITH, M.A., F.R.S.E., Surgeon to the Bristol Royal Infirmary, Professor of Surgery, University College, Bristol. Fifth Edition. Two Vols., 8vo, pp. 1171. London: J. and A. Churchill, 1896.

This treatise was written by a surgeon who was more anxious to save his patient than to possess a reputation as a brilliant and daring operator. This fact may be discerned in almost every chapter of the two volumes. Not that Professor Smith gives one the impression that he ever stayed his hand from timidity. On the contrary, we feel sure, as we read these pages, that no personal considerations ever had the slightest weight with him in comparison with the life of his patients. The work abounds in pithy maxims. The following sentence deserves to be emblazoned on the walls of every operating room: "The prime object in surgery is not to perform a scientific and technically complete operation, but to save life." This sentiment animated the author in life, and embodied in this his latest writing may serve as a worthy and fitting epitaph. In general, the book is a model of industrious research, and must long be a hand-book for the abdominal surgeon. The historical introduction which appears as a preface to each operation is particularly full and interesting. American surgeons are given free and generous recognition for their part in developing the technique of abdominal surgery, to McDowell being accorded the full credit of the first ovariectomy, notwithstanding that Tait has claimed this honor for one of his own country. In that part of the work which relates to general diagnosis there is a valuable table which might well be transferred to a card for the purpose of bedside use. We

are too often apt to forget the possibilities in making a diagnosis of abdominal conditions, and if we were always compelled to go over such a sch  me seriatim, excluding one possibility after another, we should gain in diagnostic ability and sometimes be saved from mortifying mistakes. Under the subject of diagnostic methods one must regret to see omitted that of auscultatory percussion, certainly a most useful aid. So, too, it seems as if too little importance is given to inflation of the stomach for diagnostic purposes, and too much to the discomfort to which it may subject the patient. With a bicycle-pump and a stomach-tube inflation can be easily practised and readily limited to the actual necessities of the case, something which is not possible with the carbon dioxide of the seidlitz powder, nor, indeed, ought a momentary discomfort be allowed to stand in the way of an accurate diagnosis. The plates of cross sections of the abdomen in different pathological conditions will give to the beginner in abdominal work a vivid idea of the possibilities of error and the methods of observation by which error may be avoided. The paragraph on "exploratory incision" is one that deserves to be read and reread. Nothing more judicious can be found in a work which is full of judicious sayings. Under the head of nursing, the use of the catheter is thus spoken of: "The nurse should be able to pass the catheter without exposing the patient." Exception must certainly be taken to this statement. The catheter cannot be passed on a woman with due regard to those precautions which are necessary to prevent infection of the bladder without exposing her, and it is better to expose the patient than to run the risk of an infected bladder, by no means a theoretical or imaginary risk. The paragraphs which treat of the purification of the hands of the surgeon will not receive universal assent. A one to thirty solution of carbolic acid, which the author recommends, would certainly prove at first benumbing then irritating to the hands of surgeons who have been accustomed to the use of simple solutions of bichloride of mercury or to the perman-

ganate method of Kelly, which the author commends in cases requiring extra care. Exception may, perhaps, be taken to this latter phrase, for extra care in one case implies less care in others, and there is no occasion, certainly where an abdominal section is called for, which does not demand the greatest possible care always. The preference of the author for sea-sponges for abdominal work will not find general favor on this side of the water. "The preparation and purification of sponges require the most careful and close attention." This is certainly true, and is in itself an argument against the use of the sea-sponge, provided a material can be found of which this statement cannot be made. American surgeons, as a rule, prefer to use sponges which are made of coarse gauze. These are readily and cheaply made, easily sterilized, and used but once. Similarly laparotomy sponges may be made of the same material in several thicknesses and of suitable size. It has been found that sponges, either hand or laparotomy, which latter correspond to the sponge cloths of the author, when made of gauze, do not lack absorbent qualities. The position of Trendelenburg does not find favor with the author, though his objections are stated in his usual temperate and considerate manner. It is possible that the position is often used in a routine manner. The reviewer has sometimes found the ordinary position more advantageous in just the class of growths—"large, solid tumors"—instanced by the author, the view of the parts behind the growth being hindered rather by the Trendelenburg position. Under the head of sutures, perhaps too much stress has been laid upon "filthy materials" as causing stitch abscesses. No mention has been made of the part played by Welch's coccus in the genesis of these pests of the surgeon who makes a practice of traversing the infected layers of skin by a through-and-through suture. The remarks on the necessity of drainage are not in line with Clarke's observations on this subject, made on a basis of all the abdominal operations at Kelly's clinic in Baltimore. Under the head of after treatment,

we are a little surprised at the advice to administer the coal-tar derivatives. This seems like purely symptomatic treatment, not likely to do good in grave cases and unnecessary in others. In mentioning the parotitis which occasionally follows abdominal operations, this is ascribed to reflex nervous influence. This seems hardly in accord with the pathology of inflammations. The author's description of the various operations required by diseases of the abdominal organs is full, complete, and brought entirely up to date. Here we find much more than a manual of operative surgery. The pathology of the various conditions requiring operation is the least satisfactory part of the book, but the indications for operation, the choice of operation, and the consideration of clinical facts bearing on these points are full of good, hard, Anglo-Saxon common sense, tempered with humanity. An operation of gravity is never advised where one of less gravity may serve the purpose, as, for instance, with regard to the operation of ovariectomy or removal of the appendages for the relief of a growing myoma, where the author remarks, "If cases of uterine myoma are kept under close and constant observation, and treated by removal of the appendages sufficiently early, the field of hysterectomy for this disease will be greatly diminished." This is an observation which few will be willing to contradict. The proposition of the author to treat the pedicle, in a hysterectomy for myoma, extraperitoneally is distinctly disappointing. By pedicle the author evidently means what is left behind in a Baer's operation,—the cervix. Undoubtedly, if the method described is followed, by which the uterine arteries are not secured and hæmorrhage from the pedicle is to be guarded against by a mass ligature, sloughing with infection of the devitalized tissue through the cervical canal will be a common result of such a procedure. If, however, the method of Baer is followed, no such sequel is to be apprehended in the experience of surgeons in this country. It seems a pity that in a book of this character we should be advised to return to the old method

which involves the tedious separation of a slough, in itself an abomination in modern surgery. The curved incision, advocated in Alexander's operation, with the formation of a flap exposing both external rings, seems like an altogether unnecessary disturbance of tissues. The various operations on the stomach are well and fully described, though a secondary place has been given to the methods of Witzel and Frank, operations which have found the most favor in this country. Under the head of gastric ulcer there is a very full description of that somewhat rare affection, subphrenic abscess, which is again referred to at the close of the second volume in the chapter on "Purulent Collections in the Abdomen." Taken together, these two treatises are, perhaps, the best on this subject that have appeared in any of the late works on surgery. With regard to the operation of total gastrectomy, in referring to Connor's unsuccessful case, done in Cincinnati in 1883, Professor Smith remarks, "He [Connor] says nothing as to how the vitality of the colon is to be provided for, and produces insufficient evidence to show that the operation is either feasible or proper." Since this sentence was penned, less than two years passed before Schlatter's successful case, and this has recently been at least twice repeated in this country,—significant evidence of the rapid progress of our art! Nearly half of the second volume is devoted to the surgery of the intestine, which is treated in a manner truly exhaustive. American surgeons receive well-merited and ungrudging praise from the author for their work in this direction. With reference to the Murphy button, the following comment is made: "No hospital surgeon, accustomed to interpret the effects of gangrene in the bowel, even if of limited extent, can regard with equanimity the deliberate production of two gangrenous rings around the divided ends." Now this is just exactly what ought not to be produced as a result of the Murphy button. If the two halves are pressed together too firmly then we should have a gangrenous ring as a result. If, however, as is the intent of Dr. Murphy, only suffi-



cient pressure is maintained to keep the peritoneal surfaces of the two ends firmly together, then we may expect a pressure atrophy to occur, which will result in the discharge of the button in about two weeks. The subject of intestinal obstruction receives much attention from the author, and his judicious suggestions are many. No better illustration of his mental temperament can be found in the work than in this chapter. He is bold, but not too bold. Operation is advised at as early a moment as the diagnosis will permit. The use of purgatives is deprecated. The marrow of the whole subject is contained in a single sentence, "An operation for intestinal obstruction is certainly not completed till the cause has been removed; but if the cause can be removed only after a prolonged and difficult operation, at the expense of the life of the patient, then I maintain it is better to temporize, save the patient's life by enterotomy, and remove the constriction afterwards, when the patient can bear it." One may object, however, that cases of constriction by either volvulus, intussusception, or bands usually involve the occurrence of gangrene, and are not likely to be helped by the creation of an artificial anus, if nothing more is done. Even if gangrene does not happen, we are never in so good a position to explore the abdomen after adhesions have taken place as at the time of the first operation. Cases likely to be relieved by the creation of an artificial anus, with subsequent operation, are most likely to be those of a malignant disease, where an annular constriction of the gut has been produced. Here, where the affected loop can be drawn outside the abdomen, it may often be the part of wisdom, in view of the exhaustion of the patient, to perform a Maydl's operation with immediate opening of the intestine, and leave more radical measures to a later date. Then, too, there are cases where the obstruction necessitates an artificial anus, high up in the small intestine. Here death will occur from inanition through the escape of the intestinal contents before absorption has taken place; and it is evident that the risk of a complete operation is unavoidable, for

nothing else will be of service to the patient. The chapter on appendicitis is one of the best that has appeared in any work not a monograph on this particular subject. The author is inclined to be more radical in his views with regard to the propriety of early operation than is the case with most English surgeons or their neighbors on the continent. He thus places himself in line with the American surgeon. The remainder of the work is devoted to the surgery of the kidneys, the bladder, pancreas, and liver. The different operations are fully described and well illustrated. In the chapter on pelvic suppurations Professor Smith takes the unequivocal ground that, where it is practicable, drainage should be through a vaginal cut, especially if the condition of the patient be bad and the abscess large. He restricts the cases for abdominal incision to those where the abscess is small or where the condition of the patient is especially good. His final observation on this subject is as follows: "It is possible to do too much in these cases; a complete and perfect surgical technique may be carried out at the expense of the patient's life." This sentence not only sums up the author's opinion concerning operative procedure in pelvic suppuration, but is an epitome of the practice of surgery as exemplified throughout the work. The safety of the patient is always the writer's first thought. As a whole, this work is one of the best treatises on abdominal surgery that has ever appeared. The distinguished author has laid down the pen and has been gathered to the bosom of mother earth. His book is his best monument.

A. T. BRISTOW.

A TEXT-BOOK ON SURGERY; GENERAL, OPERATIVE, AND MECHANICAL. By JOHN A. WYETH, M.D. Third Edition, revised and enlarged. Large 8vo, pp. 997. New York: D. Appleton & Co., 1898.

Professor Wyeth's book, upon its first publication, in 1887, was reviewed somewhat at length in the *ANNALS OF SURGERY*, and its excellent features pointed out, although notice could not

fail to be given to the reluctance shown by the author then to depart from some of the ancient landmarks and to fully accept the most recent bacteriological and pathological doctrines. Surgical history has been making rapidly during the ten years that have since elapsed, and he who takes up this text-book to-day and compares it with its predecessor of ten years ago must be impressed by the change. The general features of the work, of course, are the same; there is one large octavo volume, with large, clear type, good paper, and abundant illustrations. Necessarily there is great condensation and brevity of statement in the text, but its teachings are clear and positive; there is never any trouble in comprehending what the author means to teach. Opening the book we miss at once the table of contents, which has evidently been omitted in the effort to keep down the bulk of the book. Its omission is, however, more than compensated for by the great improvement and enlargement of the index at the close of the volume. Eleven pages sufficed for this most important part of a reference book in the first edition, while thirty pages are devoted to it in the present one. The first chapter of the original work was devoted to surgical dressings, and not until the fifth chapter was reached was to be found any presentation of surgical pathology. In the present edition pathology is given its proper place and proportion of attention, the first six chapters being devoted to it. The relations of bacterial infection to inflammation receive full attention and clear statement in these chapters; in the former edition it was not mentioned at all. As an example of the advance which so short a period as ten years can make in the views of so advanced a thinker and energetic worker as is the author of this work, his presentation of so common a condition as that of "cold abscess" is interesting. In six lines the subject is dismissed in the first edition, the chief remark in connection with them being that "they occur, as a rule, in diseases of bone and joints, and in individuals of low vitality. Cold abscess is not infrequent after caries of the spine, and after

adenitis of the axillary region." In the present edition a whole page is occupied with the subject, in which their origin in tuberculosis of bone or lymph-node is clearly set forth, the pathological processes which attend them are well described, and the course which they pursue and the treatment required are adequately stated.

The book is full of similar betterments, and we congratulate the author upon the fidelity and skill which he has shown in bringing the work up to date. One peculiarity in the arrangement of subjects is noticeable,—viz., the dislocation of urethritis from its position among the diseases of the genito-urinary apparatus and its placement by itself in the fore-front of surgical diseases, with erysipelas, tuberculosis, and diphtheria. The arrangement seems odd, yet one recognizes that there is a reason for it in the bacterial origin of the disease. It would seem, however, more rational still to give a yet greater prominence to the rôle of the special bacterium, and under the head of "gonococcus infection" describe its effects upon the various mucous tracts and upon the joints; in such a presentation urethritis would, of course, play a prominent part, but endometritis and salpingitis would occupy quite as much attention, while proctitis and conjunctivitis would not be overlooked. The inflammatory lesions of the urethra, as a special region, certainly belong to the domain of special surgery, and the placing of them at the head of the chapters devoted to general surgery is a fair subject of criticism.

In the section devoted to the operating room, Jove was not only nodding but must have been soundly asleep, when for the plain, substantial, serviceable operating table, depicted in the first edition, there was substituted the dreadful contrivance with the odd name which is figured on pages 88 and 89 of the present edition. Certainly this table, upholstered, carved, ornamented, with its combination of leather, wood, and iron, is more suitable for a library than for the operating room of a surgeon. We miss,

in this connection, any statement of the reasons why iron and glass and the utmost simplicity of model have become considered as essentials of the operating tables of to-day, but are pleased by the gleam of returning reason shown in the final sentence, in which it is stated that "a plain inch plank, six feet long and twenty or twenty-two inches wide, and two wooden benches or horses, such as carpenters use, of proper height, will suffice," to which we heartily assent.

There is occasion for further criticism, also, in the directions given on page 92, that a surgeon about to proceed to an operation should clothe himself in a water-proof gown, long enough to reach his feet, and should protect his feet with rubber boots or wooden shoes! This is evidently a relic of that period of the evolution of antisepsis in surgery when value was believed to exist in the abundance and continuousness of the flow of antiseptic solutions over the field of an operation, and when in consequence everything around was awash and afloat. Such a course is now as antiquated as is the carbolic spray, and with its passing has likewise passed the need of equipping a surgeon like an Ostend or Cape Cod fisherman.

It is impracticable to describe in detail all the sections of the book; a few selected features must suffice. It is noteworthy that the consideration given to general infective diseases is quite full and satisfactory. The surgical side of diphtheria, typhoid fever, and leprosy is not neglected, while the importance and characteristics of tuberculosis are especially emphasized. As to operations for carcinoma of the breast, Wyeth's dictum is that it is "as important to remove the entire lymphatic apparatus from the clavicle through the axillary space down to and with the breast as it is to remove the breast itself," with which we fully concur, but wish that he had mentioned also the frequency with which the supraclavicular lymphatic apparatus is also involved, and the necessity of removing this to secure the complete removal of the disease.

In operating for the radical cure of inguinal hernia, Wyeth preserves the sac after the method of Macewen. In dealing with malignant disease of the rectum, the only method described is one involving an osteoplastic partial resection of the sacrum. Inasmuch as by far the greater proportion of rectal cancers are situated so low down as to be susceptible of removal without the help of any more radical attack on the pelvic bones than a simple excision of the coccyx, it would seem as if some suggestion of these less formidable methods should somewhere occur. In dealing with enlargements of the prostate, with intractable obstruction, suprapubic cystotomy and permanent suprapubic drainage is the only method of treatment suggested.

Accepting the book, however, as a statement of the opinions and methods of the particular surgeon who is its author, and not as an exhaustive exhibit of the problems and methods of surgery, as held by his contemporaries, one cannot but admire it. There is far more to commend than to criticise in it.

LEWIS S. PILCHER.

LEHRBUCH DER SPECIELLEN CHIRURGIE FÜR AERZTE UND  
STUDIRENDE. Von DR. FRANZ KOENIG, Siebente Auflage,  
Band I, Berlin, 1898. Verlag von August Hirschwald.

[Text-book of Special Surgery for Practitioners and Students  
of Medicine. By DR. FRANZ KOENIG. Seventh Edition.  
Volume I.]

Our favorable criticism of the sixth edition of this work may be applied to this, the seventh edition, so far as we can judge from the first volume. This volume has been revised and enlarged by some sixty pages. Some additional illustrations have been introduced. It is one of our best surgical works.

JAMES P. WARBASSE.

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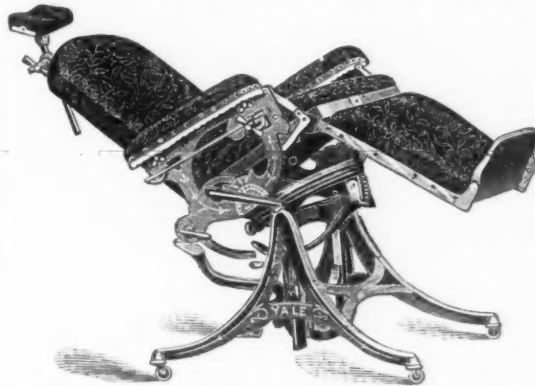
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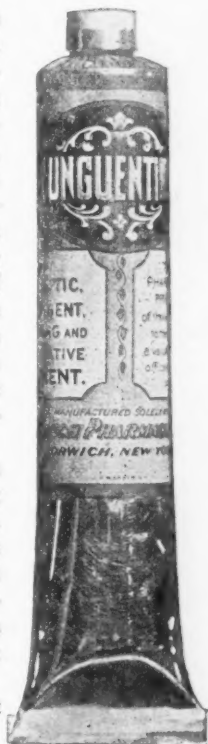


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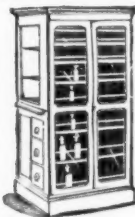
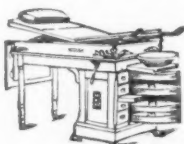
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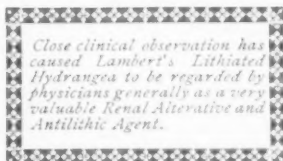
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## Nobody's Fool.

NOT one look backward did he give, not one sign that he heard the angry cries of his deserted wife. The distance widened. The boat slowly at first, then with increasing speed, slipped away into the dusk of the falling night and the shadows of the river; and at its prow, motionless as the flag-pole beside him, the figure of Jim.

The woman fairly raved. Her language was so shocking, her rage so violent, that even the creature who had been her lover shrank from her in disgust. Finally, seeing an old man in the gaping crowd who seemed to take a knowing interest in what was passing, she turned upon him.

"Jake Rollins, you know about this. What did Jim mean by goin' off like that? What's he been up to? Whar's he goin' to? Answer me, you ———!"

"Wal, Mrs. Parsons, you see it's this way," he began. "I don't know whar Jim's a-goin' to, nor I don't know why he's a-goin',—though maybe as how I kin guess. All I knows is that Jim's done sold all he's got,—the house, an' the stable, an' the lot, an' all the furniture, an' the cow, an' he's got the money with him. I knows that, fur I seen it. An' when I seen Jim a-standin' on the boat thar, an' the boat a-leavin,' I says to myself, says I, 'Jim's a-goin' away.'"

During this recital the woman had grown deathly pale. Now she leaned gasping against the door of the wharf-house. "An' did Jim leave no word fur me?" she panted.

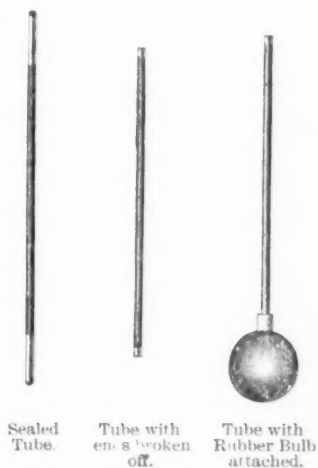
"Wal, now, he did that," replied the old fellow, with a touch of pity in his voice. "Jim says to me, just afore the boat come, he says, says he, 'Jake, ef my wife asks ye what word I leaves her, jes' tell her I says I ain't nobody's fool.'"—*L. S. Bernard, in December Lippincott's.*

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Should the irritation prevail in the morning or at mid-day, the same course of administration should be observed until subdued. In neuralgia, in short, for the multitude of nervous ailments, he doubts if there is another remedial agent so reliable, serviceable, and satisfactory, and this, without establishing an exaction, requirement, or habit in the system, as morphine does.—*New York Medical Journal*.

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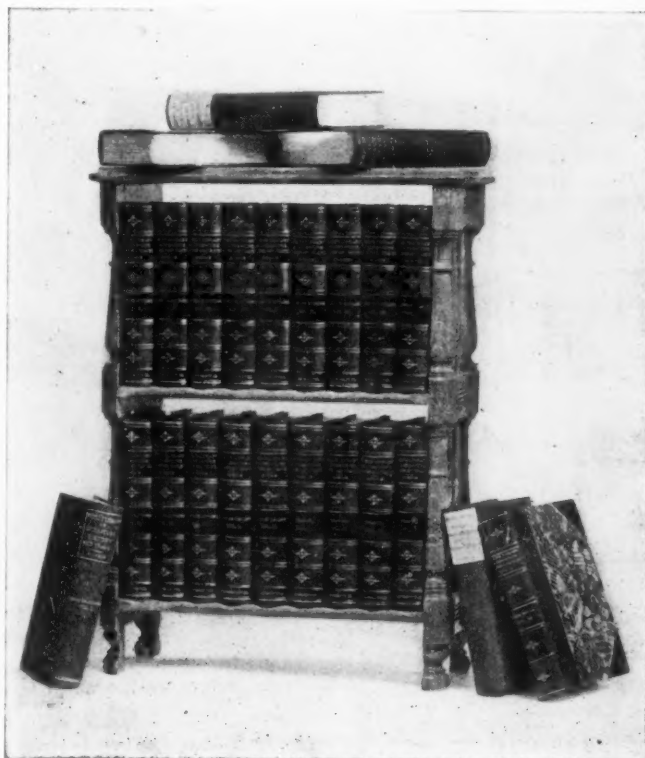
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# ANNALS OF SURGERY

A MONTHLY REVIEW OF SURGICAL SCIENCE AND PRACTICE

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LEWIS STEPHEN PILCHER, A.M., M.D.,  
OF NEW YORK,

WITH THE COLLABORATION OF

J. WILLIAM WHITE, M.D.,  
OF PHILADELPHIA.WILLIAM MACEWEN, M.D.,  
OF GLASGOW.W. H. A. JACOBSON, M.Ch.,  
OF LONDON.

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